

Historic, archived document

Do not assume content reflects current
scientific knowledge, policies, or practices

FO
a50428
A 2026
RESERVE

FOREST LAND PROBLEMS

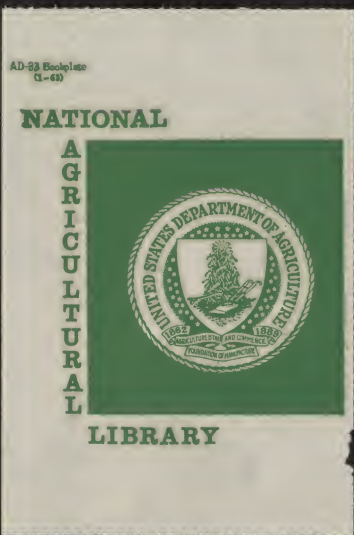
IN

CALIFORNIA

U. S. FOREST SERVICE

REGION 1

MARCH 1946



2001 ✓

FOREST LAND PROBLEMS

IN

3001 ✓

CALIFORNIA

U. S. FOREST SERVICE

3002 ✓

REGION 5

MARCH 1944

Table of Contents

	<u>Page</u>
Duties of Mountain Lands in Rural Economy.	1
Water Management	3
Timber Management.	5
Forest Range Lands	7
Wildlife Management.	8
Minerals	9
Forest Recreation.	9
Problem of Land Ownership.	10
Fire in the Management of Forest Lands	11
Research Program for California Forest and Range Lands	12
Surveys and Inventories on Forest Lands.	14
The Transportation System for Forest Lands	16

U. S. DEPT. OF AGRICULTURE
NATIONAL AGRICULTURAL LIBRARY

JAN 21 1972

CATALOGING - PREP.

343921

Fo
aSD428
.A2076
RESERVE



DUTIES OF MOUNTAIN LANDS IN RURAL ECONOMY

Proposition

This background section examines the proposition that the mountain timber, watershed and range lands form an integral part of the rural and whole economy; that, due to past misuses and current deficiencies of attention, they are progressively dropping behind in performing their natural roles; that, due to the inescapable time lag to obtain the full potential of production and services, large-scale programs of betterment should be started now; that the dollar economics of such programs are to be judged by additional returns from the whole economy.

In the later sections dealing with each of the six primary products and services of mountain lands, specific attention is given to the reasons for aggressive development programs, to the kinds of measures proposed, and to their extent.

The parts are more readily reviewed if the whole is sketched first.

Public Recognition of the Relationship of Mountain and Valley

Segments of the rural population early discovered that they had a practical stake in treatment of mountain lands. The expanding livestock industry in this State discovered in the 1870's that mountain ranges effectively complemented the forage and feed supplies of the valleys. The Sacramento Valley farmers in the 1880's battled out of existence hydraulic mining (i.e., concentrated erosion) because it damaged their farm lands and their water supply. The farsighted southern Californians, disturbed by winter floods, summer failure of natural flows, and cropland destruction from floods following mountain brush fires, took a leading role in establishing in 1893 the early Forest Reserves as a means calculated "to insure favorable conditions of water flows." The farmers and rural people, dependent from the start on nearby mountain forests for essential wood supplies, actively supported the establishment of Forest Reserves in northern California as a necessary means of insuring "supplies of timber for the use and necessities of citizens of the United States." Even in pioneer days the habit of recreation in adjacent forest areas became an established and cherished part of rural life.

The assertion of practical interest in mountain lands has become both more intense and more diverse as the structure of rural life has grown larger, more complex, and more specialized. One illustration of this has been the historically recent growth of the many forms of single-purpose management areas, both Federal and State, contrasting in intent and method to the general utility reservations of earlier years.

And, with the growth of the cities and the wholesale use of mountain areas by city people, conflicts in interests have developed between rural and urban groups. Organized group assertion of these interests is both alert and aggressive. Thus we start, in this analysis of current and foreseeable conditions, relationships, problems and programs, with widespread, well-established public interest and acceptance of methods of public action.

The Separate Native Values of Mountain Lands

Forty-seven million acres of mountain lands are the source of water used in the rural or general economy, and 40 million acres are of such a character that treatment may deteriorate the water-conserving values up to the point of nearly complete destruction.)

There are 20 million acres rated as actually and potentially commercial forest lands, and all are vulnerable, up to the point of complete destruction of both young and mature timber.)

Grazing of domestic livestock is practiced on 30 million acres, of which 24 million are rated as permanently economic. All are vulnerable to damage, and many to the point of virtual destruction.

Deer graze in summer or winter on 45 million acres.

Recreational values are recognized on 27 million acres. Since these values are inseparable from appearance and attractiveness of forest lands, they are vulnerable to destructive processes affecting the watershed, timber, and range values.

Mineral values are known or believed to exist on one million acres. Treatment of land for the organic resources can affect but little the minerals, but existing methods of mineral exploitation can injure, to the point of destruction, the land surface and therefore the other values on many vital areas, and thus complicate management.

The Multiple Values of Mountain Lands

The above single acre values total 165 million acres occurring on an actual land area of 47 million acres. That is, many areas have from 4 to 6 separate values, and the single-purpose areas are in a minority. If, and to the degree then, that the economy requires full and intensive use and management of all resources, the most, and indeed only effective management must in the main be all-purpose in character. This conclusion is dictated by the relative scarcity of each resource in comparison to need, and to dwindling chances to import from other regions.

Past Use and Treatment of Mountain Lands, and Effects on Present Condition

Only major and powerful elements need listing here.

Unfavorable Factors

1. Natural Vulnerability to Damaging Processes, and Slowness of Recovery.

The important timber species are, except for redwood, exceedingly susceptible to fire, insects, and disease, do not reproduce by sprouting, and have exacting requirements for reproduction by seed. Our forests are not like the tropical jungles in their vigorous capacity to recover regardless of treatment.

The most important forage species are readily destroyed by use, as were the native perennial grasses of the Sierra foothills, and as was bitterbrush on large areas of the east Sierra.

Most mountain areas have soils and topography from moderately to highly susceptible to erosion. The absence of top soil from millions of acres means less than full ability of the soil to absorb water and to produce tree or other crops.

The universal aggressiveness of brush species in capturing land vacated by higher types means an always slow, unsure fight to recapture. On high-quality timberlands, for example, even with seed trees, decades may be required for young trees to establish themselves in competition with brush.

Manipulation of our mountain lands is a highly tricky business.

2. Fire. At least in recent centuries, most mountain lands were burned over repeatedly, even before occupancy by the whites began. Since all uses of mountain lands by civilized man employed fire, the intensity of burning speeded up until about 1900, when the first widespread attempt to control fires began. It was, for example, common practice for stockmen to fire the ranges in the fall, for prospectors to burn off the natural cover on areas of interest, and for lumbermen to fire their slashings. Since then, the rate of burning has progressively been slowed down in most areas.

Most common accumulated effects of fires included:

- Substitution of brush for timber on several million acres.
- Thinning, often to mere vestiges, of timber stands, and capture of the ground by brush on several million acres.
- Loss of topsoil through erosion of brush watershed lands, and consequent reduction of absorption efficiency of the land, on millions of acres.
- Substitution of brush for grass, and of undesirable for desirable forage species in natural brushlands.
- Destruction of natural attractiveness of the original climax types.
- Multiplying the problem of fire control on lands captured by brush.
- Creating an enormous task of recapturing from brush the good timber, range, and watershed lands, over and above the recapture by unaided, natural processes.

3. Exploitation Attitudes and Practices. The pioneer's attitude included not only aggressiveness, daring, and a passion for individual freedom, but a ready acceptance of the myth of inexhaustibility of timber, range, and cropland. His current problems were so urgent, and competitive pressure so severe, that he had little inclination to contemplate philosophically the ultimate consequences of his own patterns of using land. There was a general belief that there was plenty of land and resources; that if one piece of land or resource was exhausted, another would be waiting. There were, of course, exceptions.

Attempts to modify the practices which became firmly embedded in the pioneers and their successors have faced the most stubborn inertia. Even today it is considered by many to be unmoral to urge the need for public regulation of logging on private forests, or of any other measure designed to protect the interests of the whole economy, and timber liquidation programs continue despite the well known end results as demonstrated in older regions.

4. Use of Land for Unsuitable Purposes. Experimentation in forms of land use, through trial and error, was inevitable, since research lagged. Thus large areas of hill land were cleared and plowed, even though water values were thereby damaged, and the plowland itself eventually failed through the induced erosion.

Widespread attempts to improve forage production in brush areas by burning continue as a phase of mountain land use, despite the self-defeating end result of the practice, and despite the fact that the highest benefit to the economy comes from managing such lands for watershed and wildlife.

Conversion of good timber lands to forage, notably on the Douglas fir and redwood hills, has continued to date, though this is clearly injurious to the whole economy.

Destruction of cropland values by dredging gold for storage in subterranean vaults has nibbled away at the bank account of usable land, even though it is often feasible to first strip and later restore the top soil.

These and similar practices represent a process of attrition which has reduced the area of land now useful in the whole economy.

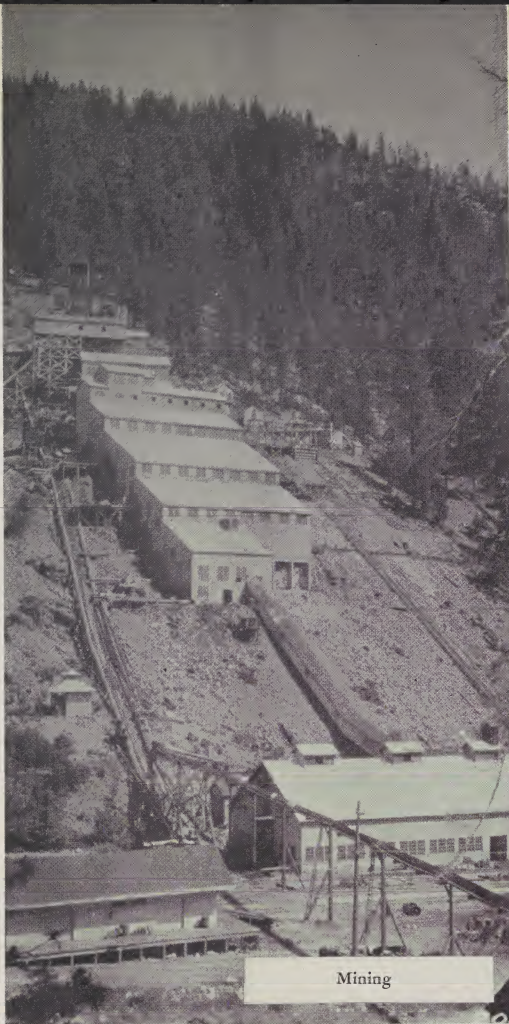
5. Liberal Policy of Passing Lands to Private Ownership. Widespread opportunities existed for application of exploitation practices, due to the fact that initial settlement coincided with the period of liberal public land laws. The best and most accessible lands naturally moved to private ownership, since the land-hungry pioneers generally regarded land as the one solid base for individual prosperity. Mountain lands went to patent because someone saw an imagined chance for quick profit within his own lifetime by exploiting accumulated values.

The reasons for the policy are well known, as is the fact that the land laws, designed to aid individual settlers, were grossly abused by corporations.

6. Pressures on Private Ownership by the Money System. A major obstacle to better practices arose from the early as well as rapid development of the rural economy into a pattern of businesses in which success or failure was measured in monetary returns and not as a way in life. The widespread use of borrowed capital and high interest rates tended to compel, or at least make it easier to adopt measures creating devastation. The influence of local taxation burden and the lack of strong or stable programs of public cooperation also tended to push private ownership towards exploitation.

The stability of private ownership for much of the mountain lands is clearly indicated by the degree of habitual tax delinquency, which is far more prevalent than in the valley. Every tax-delinquent property represents a finding that, under the types of use available to private owners, the lands are not permanently suited to this form of ownership. Tax delinquency is a powerful symptom that private ownership of mountain lands has overreached itself.

7. Growth of Single-purpose Reservations on Public Lands. The single-purpose reservation as an implement for protecting the public interest arose early. Because various groups developed specialized interest in mountain lands, single-purpose management has never lacked active supporters. To date, the following types have appeared on mountain lands: National Parks and Monuments, State Parks, Federal Wildlife Refuges, State Wildlife Refuges, Federal Reclamation Withdrawals, Federal Power reservations, Federal Grazing Districts, Federal oil and gas withdrawals, Federal mineral withdrawals, Indian Reservations, Military Reservations, municipal water supply areas, state flood control districts, mining licenses, Federal and state highway withdrawals, Soil Conservation Districts.



Mining



Lumbering



Fishing



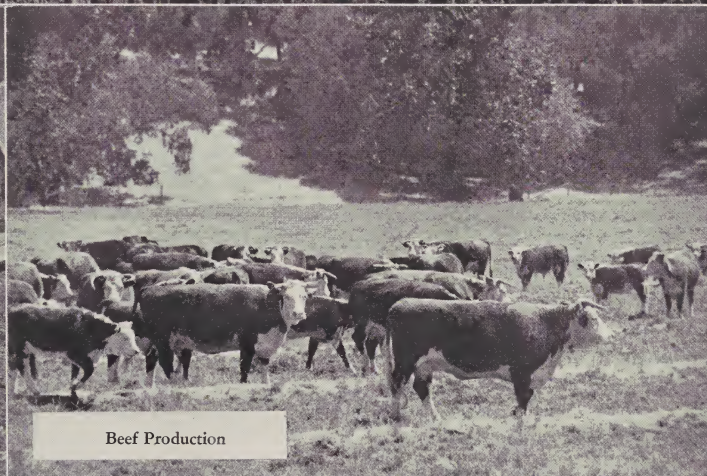
Transportation



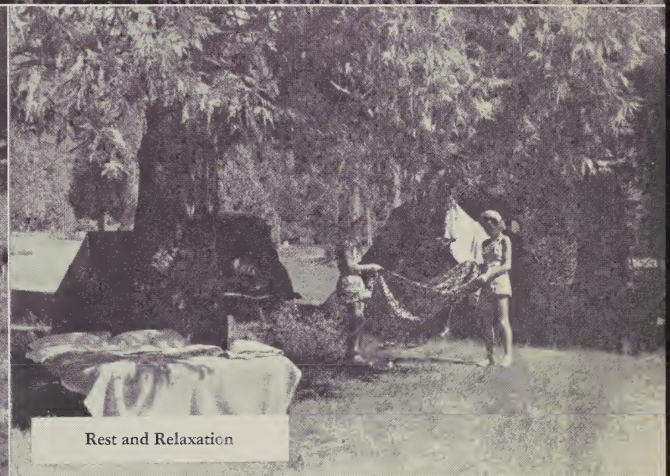
Forest Lands Provide Opportunities for Multiple Use



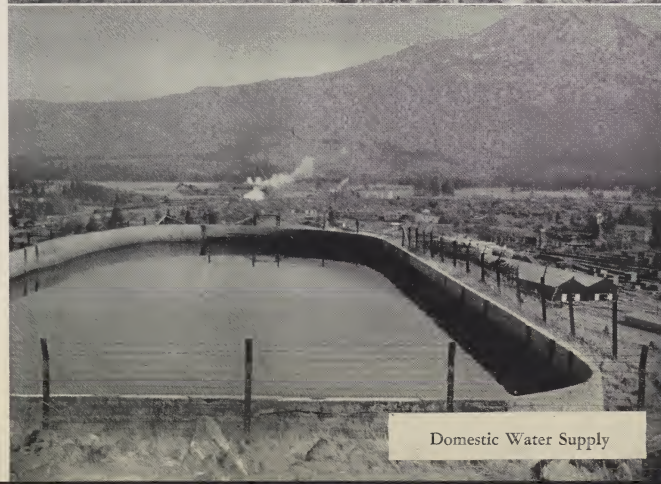
Timber Products



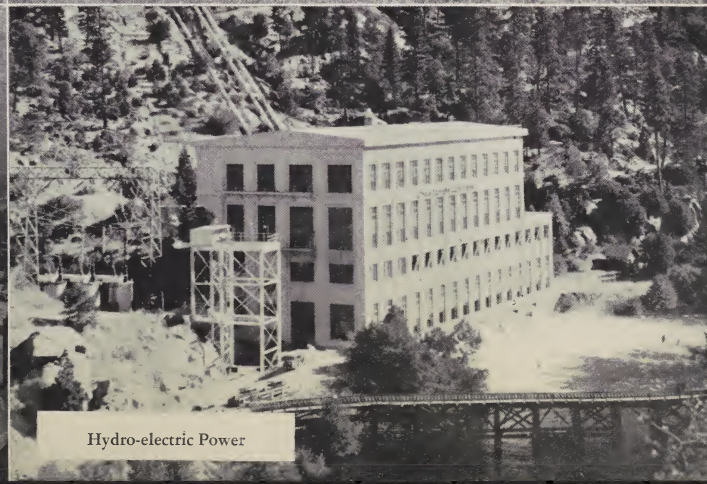
Beef Production



Rest and Relaxation



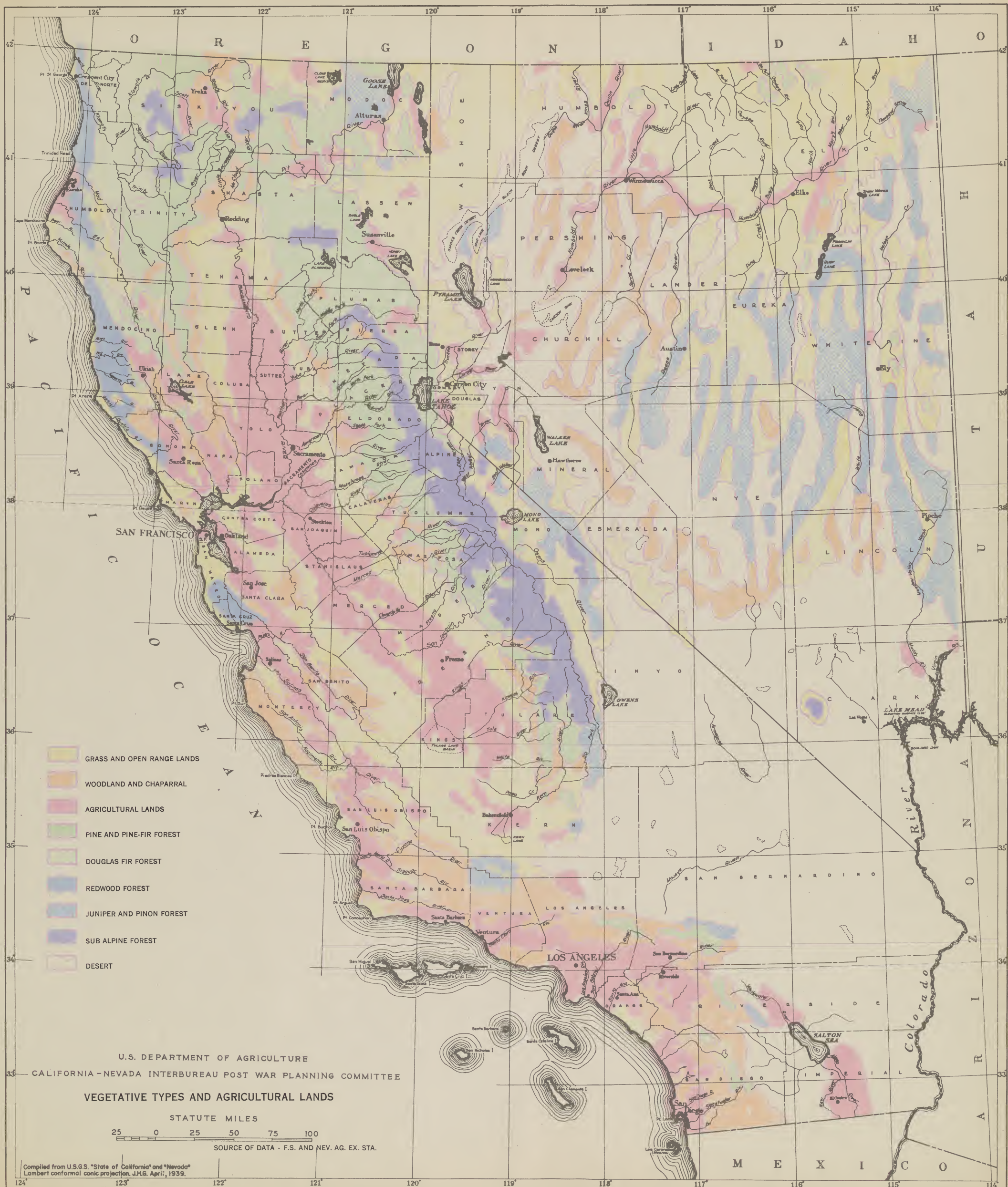
Domestic Water Supply



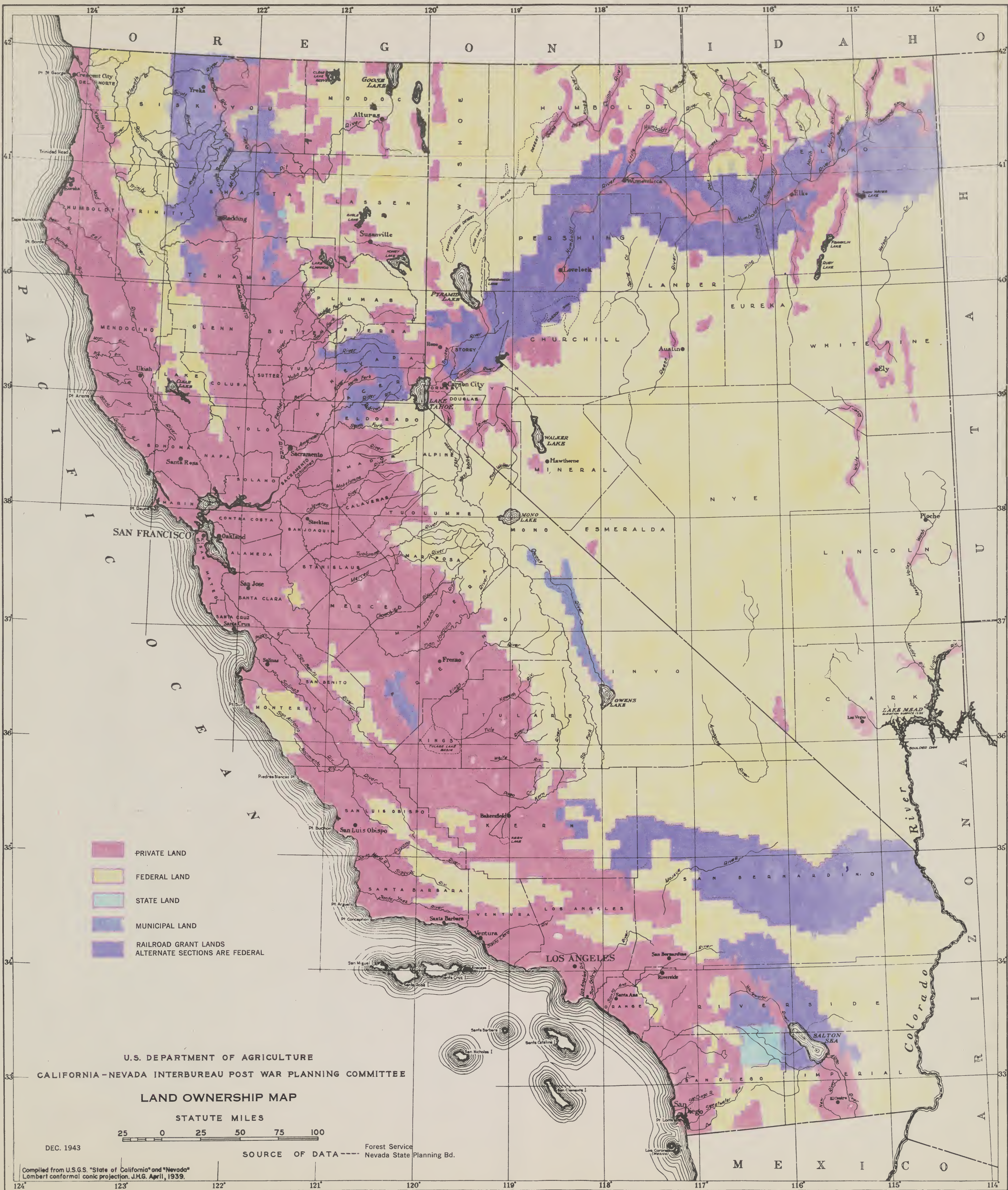
Hydro-electric Power

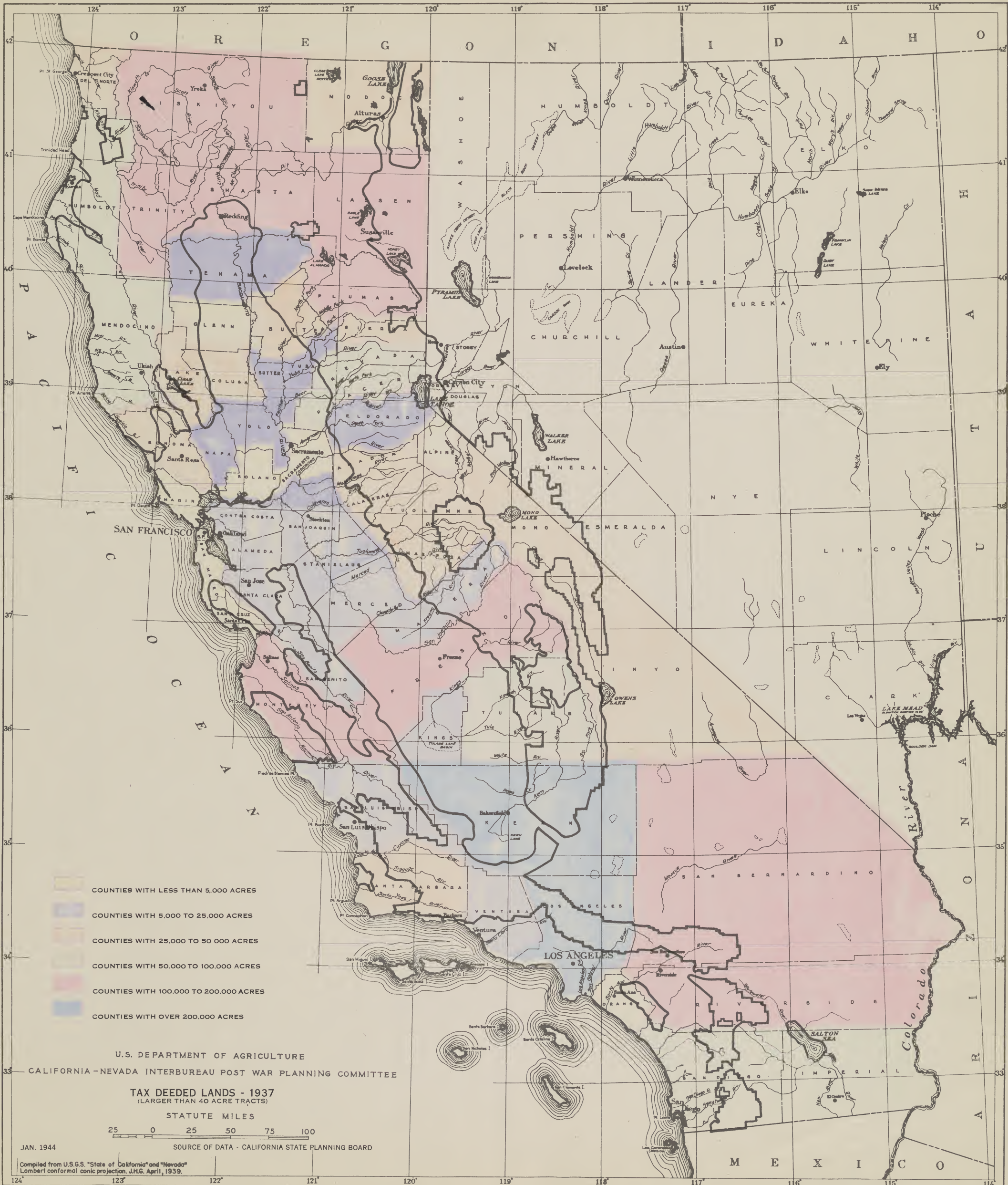


Irrigation









Some of these types are truly single-purpose; others only partially so. But they represent, in the aggregate, a substantial reduction of the mountain area available for all-purpose use. Most of the single-purpose reservations were set up without consideration of the effect on the total economy, and the finding of fact that they are genuinely required to protect the particular need served was commonly made by a very incomplete process of analysis.

That certain areas in each type of reservation are truly needed in the interest of the whole economy is clear. Equally clear is the conclusion that many areas could have their single value adequately protected under a broader pattern of all-purpose management. The problem is both one of accumulated results to date and of accelerating rate of expansion.

8. Dependence on Natural Restorative Processes. Efforts to manage both private and public timber, watershed, and range lands have depended almost wholly on curbing destructive forces such as fire, erosion, and over-use, as a prerequisite to natural restoration of values. This extensive pattern of management has accomplished a great deal, but has generally rebuilt at best but a fractional return from the true productive capacity of mountain lands. There has not been the appreciation of the need for intensive management through positive cultural practices on these lands as now exists through soil conservation programs on deteriorating croplands.

Favorable Factors

Against these processes, which have tended to reduce the values and availability of mountain lands in the rural and the total economy, are weighed those which have tended to benefit. These are:

1. The National Forest System. Historically designed in part as a servant to irrigation agriculture and the development of the West, in part a throttle to monopoly; altogether a challenge to exploitation of mountain lands and of the people dependent on them.

No single part of the program undertaken has been completely put into effect, though the annual rate of burning has been reduced from 8-10% to 0.2-0.4%; the deterioration of most ranges has been reversed; forest denudation on national forest lands has been halted; recreational opportunities have been partly developed; a beginning has been made in the management of water.

Protection and management on at least an extensive level have been reasonably effected on a large area of mountain lands.

The problem in its over-all aspects is whether the present level of extensive management is sufficient in view of the foreseeable needs of over seven million people.

2. State System of Protecting Private Lands Against Fire. Historically stimulated into being by Federal cooperative funds, the State system, though still thus supported, has gone a long way. Its vital function of fire control on private lands now covers nearly all the mountain areas of concern to the economy and not otherwise receiving organized protection. The existing level is extensive rather than intensive. A bare beginning has been made in creation of a State forest system.

3. Development of Private Protection and Management. The examples of public management have stimulated some private owners to modify former destructive practices on their lands. Losses from fire have been notably and generally reduced, but conservative logging remains very spotty. The over-all attitude of private ownership still resists public control and denies responsibility for protection of public values.

4. Development of Public Cooperation Program to Aid Private Ownership. In addition to Federal and State aid in control of fires, such programs as AAA and SCS have become factors in helping the private owner to manage his land more constructively. Through such programs, some lands formerly headed for destruction and ultimate drift to lack of value can now be counted as permanent assets in private ownership.

5. Growth of Organized Research. Although the early efforts at protection and management on public lands were severely hampered by lack of knowledge, organized research has made great strides in contributing toward a sound factual basis for operations affecting timber, watershed, and range lands. Least attention has been given to the complex relations between mountain lands and the dependent economy.

6. Growth of Public Understanding. Small groups of able citizens, working aggressively and at their own expense, were responsible for the starting and early development of public forestry. These men also began the process of public education in the whole field of conservation which has been carried forward by public officials and by a powerful and well organized Extension Service. The problem of public understanding is, in this State, never solved, because our population grows largely through migration. But general, if not always universal and whole-hearted, support for mountain land conservation, has been measurably attained. The widespread use of the mountains for recreation has been a powerful factor in developing public understanding.

Summary of Present Conditions

1. Pattern of ownership in many mountain areas is still a scrambled mess, involving government and private. Many private lands are held merely for liquidation of accumulated values. Due to mixed ownership, many areas are not managed to obtain their full contribution. Most private lands are used for a single purpose, which must produce income to the owner.

2. Unplanned pattern of public land reservations for single uses results in major withdrawal of mountain lands from all-purpose use.

3. Capture of timber and range lands by brush has been halted or slowed down on some areas, but continues on many others. Positive programs to offset accumulated effects of long period of mistreatment have not been put into effect. Thus, level of production of timber, range, and watershed lands is a mere fraction of potential.

4. Effective methods of protecting and recapturing land for highest values and restoring most useful crops have been worked out on research and pilot-plant basis to point justifying large-scale program.

5. Limitations of public cooperation programs to obtain full values from private timberlands have been established by experience.

6. Public acceptance of mountain land conservation is widespread but by no means universal. It is mostly generalized rather than specific. It is most specific as to protection phases, less so as to positive management, and least so as to need for all-purpose management to balance the books for needs and supplies. Top quality citizen leadership aggressively pushing large-scale programs, is lacking.

7. The existing level of programs for timber, watershed, and range lands is partial and incomplete. Thus, these lands are falling behind in doing their duties for the rural economy, which is developing rapidly and intensively.

The Pattern of Solution for the Most Widespread and Pressing Problems.

1. Shift to public ownership of lands unsuited for permanent private ownership.

2. Restore to all-purpose management lands not genuinely required for a single exclusive use.

3. Initiate full-scale protection programs on at least the good and superior quality timber, range, and watershed lands. More prevention research needed.

4. Initiate positive programs on good lands to aid natural processes and to obtain more nearly the full potential of the land. Additional research needed.

5. A full scale research program is needed covering the fields of (a) control of fire, insects, disease and erosion; (b) complete utilization of all wood materials grown on forest lands; (c) most effective protective and cultural practices in management and use of mountain land resources.

6. Public control of private lands to insure at least reasonable continuing productivity.

7. More complete and detailed understanding by the public is needed. Greater efforts through existing machinery to establish that mountain and valley cannot be separated.

8. New legislation making regular definite annual return to local government in lieu of taxes and stabilizing Federal contributions to protection and management of private lands.

9. A major step-up of general level of protection, development, and management in all aspects to an intensive basis. The necessarily long period required to grow timber crops, put watersheds in most healthy condition, dictates programs now to provide for foreseeable future requirements.

Expected Results of Proposed Program

1. Full and dependable, rather than partial and unsure, contributions by the mountain lands to the whole rural economy. Stability rather than varying degrees of instability. This is the type of rural economy we want, with public programs oriented to its requirements.

2. A full-scale program of mountain land development will benefit the whole economy in several directions.

a. Productive jobs. Intensive management of forest lands gives employment opportunities to at least three times as many workers as does extensive management.

b. Regional self-sufficiency for key raw materials such as wood and water not only tends to reduce consumer costs, but is an insurance against failure of or competition for imported supplies. The penalties for lack of key raw materials in war should be fresh in mind.

c. As the State's economy is modified through development of a higher proportion of industry, it is foreseeable that industrial needs for the products of mountain lands will compete with rural requirements for the same. Since the rural establishment is itself expected to continue growth, supplies of necessary raw materials sufficient for both forms of use should be the goal.

The growth of industry will broaden the base of California economy, and will surely create markets for agricultural production.

d. Specialized types of industry, utilizing economically the unused or inefficiently used byproducts of cropland production and of forest lands as well, are now technologically possible. The whole rural economy has a stake in their development.

Evaluation of Government Spending on Mountain Lands

In dealing with the costs and returns to government, simple and precise balance sheets are seldom possible, both because long periods elapse between initial investment and full returns and because many needed findings of fact do not exist.

Government, in making long-term investments, counts on four methods of reimbursement:

1. The recapture of public capital investments in public timber and range lands will come largely through direct sale of the increased production created by the expenditures. Market for the products is assured by the large and growing local consuming population.

2. The recapture of public capital investments on watershed lands can be measured in part by the increased production on croplands contributed from additional supply of usable water and control of flood damage. Under existing conditions some cropland will eventually fail and cease to produce. The producer will therefore receive a lower than possible net taxable income. The spread between higher and lower taxable incomes can be credited as a repayment to expenditures, which are, in effect, calculated to produce regular income as interest.

3. Other various forms of public assistance to private ownership which increase or perpetuate the regular production of the assisted lands, and therefore the taxable income, are to be judged as economic public investments on a comparable basis with croplands.

4. By increasing or perpetuating incomes from both public and private lands through public capital investments, the public (i.e., government) avoids the cost of caring for dispossessed and migrant people and those obtaining only a substandard living from land. These savings are to be credited to the repayment of capital investments.

WATER MANAGEMENT

Distinction between Water Management and Watershed Management

The application of sound practices in protecting and managing timber, range, and other wild lands, including proper construction of necessary roads and trails, will insure watershed values against needless damage from use. This aspect of watershed management is, therefore, protective in character, and by itself will help, in time, to restore usable water yields and reduce the frequency of disastrous floods. Full-scale water management, however, is a positive effort supplementing protection to make water perform its full duty from the time it is caught on the watershed until it leaves in the form of electric power, organic products, domestic and industrial water, or as streamflow to the sea. It will, therefore, speed up the returns obtainable from protection alone and multiply the values acquirable through water as a re-usable commodity.

Objectives of Program

A water management program, then, provides: first, for protection of watershed soil and cover; second, for obtaining maximum infiltration and minimizing evaporation losses; and third, for putting the captured water to work and concurrently curbing its destructive powers.

Such a program fully integrated with optimum use for other resources is proposed in planning all-purpose management on the forest lands of California.

Types of Projects Proposed

Water management projects to accomplish the proposed program will fall in two major categories: (1) positive measures for controlling the normal catch of rain and snow in order to make the water perform its full duty, and (2) flood or erosion control measures of which the principal function is prevention of damage. Vegetative, structural, and mechanical means will be used separately or in combinations as circumstances dictate.

These projects are planned for private as well as public lands, but with work on private lands confined to technical assistance or to improvements primarily in the public interest and amply protected as to investment by enforceable agreements or assured amortization, such as certain types of check dams, channel clearing, and some instances of reestablishing cover.

Water History in California

Water has been one of the principal resources to create wealth in California. It has played a major factor from the early placer mining days through the era when California's high head power plants made hydroelectric history, to the accelerated food production for World War II.

In '49 water was taken more or less as a matter of course, and, like gold, was where you found it. The miners soon learned that it was too scarce to go around at some seasons of the year and therefore precious. Water rights became valuable; miles of ditches were built to carry it to the "diggins." Log dams were built to store a flow for a longer season of use.

Then there came the valley farmers, who found that California rivers had a habit of overflowing in the spring and flowing too little in the growing season for valley crops. Frequent floods overflowing crop lands carried off the best top soil or left inferior soil and boulders on top of the good soil. So they began to compete with the miners for water rights.

Next came the power companies, diverting the water around the mines, and using it upstream above the farmers, with storage facilities for release as required for power rather than to fit irrigation schedules.

Growing communities meanwhile were installing municipal water supply systems that constituted a further drain on local groundwater supplies by which farmers were supplementing water diverted directly from streams. Larger cities went direct to the mountain streams for their water, carrying it across the valleys in aqueducts, which permitted little infiltration into lands en route.

Since the demand of the users was at variance with the streamflow pattern, available water was often less than the requirements of the water right owners, even in the early days. This situation had two effects: it forced more and more pumping from groundwater supplies, and it led to increasing conflicts and greater competition for streamflow waters. It was not long before water tables commenced to drop, pumping costs increased, and deficiencies in stream flow became more pronounced, particularly during irrigating seasons.

Present-day Conditions and Water Values.

Today most people in California know that bare land sheds water faster and, therefore, erodes faster than land with vegetative cover, and more are daily coming to realize that better management of the watersheds and more intensive management of water and other forest resources are necessary in solving the water problems. Most of them know that (the water situation is critical; that demand exceeds available usable water supply in all intensively developed areas; that there isn't enough in most places to meet requirements at certain times of year, while at other times uncontrolled floods do millions of dollars' worth of damage.) These conditions are evident from the published records.)

California's industrial and domestic requirements exceed a billion and a half gallons of water a day. Industries and populations are still increasing, particularly in the areas already intensively developed. Meanwhile, California watersheds are not supplying this demand. It has already become necessary to provide facilities for drawing on the Colorado River in Nevada and Arizona to supply one billion gallons a day. (The same water that irrigates farms and supplies the cities also produces 9½ billion KW hours of hydroelectric power annually, but, again, present supplies are inadequate for future needs.) More water will be needed when hydroelectric power has to replace the 935,000,000 KW hours now supplied annually by steam from gas and oil.

Federal, State, and a few private agencies have long recognized the importance of protecting cover on the watersheds as a means of maintaining or increasing the yield of useful water and retarding destructive flood run-off. This is a step in the right direction but it is a partial step from the standpoint of obtaining maximum return from water resources.

The same agencies, including power companies, water districts, and cities, have meanwhile striven for greater efficiency in single-purpose water use. All have done some exploring of reservoir evaporation losses. Power companies on the upstream areas and water companies or districts in the agricultural areas practice rigid control of water for which they have title. Snow survey has helped considerably in utilizing run-off.

Public conservation agencies have built a number of improvements on forest lands for range, wildlife, and recreation which serve dual or triple purposes, although in most instances multi-purpose benefits were incidental to the fundamental intent for the installation.

Despite progress that has been made to date in meeting the water problems, flood damages continue to offset many of the watershed benefits almost every year. Millions of dollars of capital investments in California are represented by downstream flood-control improvements which offer little help in augmenting the uses of water.

In view of the importance of the water crop as a forest-land resource, it clearly deserves more intensive study and management than it has been accorded to date.

Water Rights

A complicated pattern of riparian rights and flowage appropriations confronts anyone devising a plan to expand the use of California water. There is little, if any, free water left in the low country. Occasionally, unappropriated springs and some peak streamflow may be found on the forest lands, but here, too, firm flow has all been taken up. Contested and overlapping rights are common throughout the State. In recent years prompt application to beneficial use has become a prime consideration for allowing new appropriations, while courts have shown growing impatience with riparian owners whose water practices are contrary to public interest.

Water rights must be recognized in molding post-war water management programs. Many problems have to be solved before all plans can be put into effect. Water laws must be revised, priorities of diversion adjusted, allowable drawdowns of water tables determined, and conflicting demands of low-land uses reconciled. People who stick to outworn conceptions of water as property must be converted to believe that State progress and their own ultimate welfare is contingent upon water use consistent with public interests. All of these things, then, must be considered in scheduling activities for regulating upstream waters.

The water-right situation, however, need not preclude water management activities on forest lands. Far-thinking water users are already open-minded toward any suggestion that offers a possibility for expanding water use on any area and are willing to cooperate in its achievement. Advanced thinking by others rapidly follows accomplishment in organizing upstream waters. Local support can be obtained, therefore, in 9 cases out of 10, if water-management activities are harmonized with current operating schedules of water-right holders to protect them against jeopardized rights.

What Should Be Done About Water Management in California

A comprehensive, fully integrated plan must be put into effect for controlling the catch of rain and snow on the 73,300 square miles of forested watershed lands. The old concept that watershed protection is water management must give way to the realization that increased water benefits can be obtained only by treating the water as a forest crop as well as a downstream commodity and managing it with the same intensive methods practiced in handling other forest-land crops.

The amount of rain and snow which falls on an area has been accepted as dependent upon the whims of the gods; something that cannot be materially affected by any scientific means upon which man can now rely. This is true. But, while the available water in the form of rain and snow cannot be increased, that water can be made to produce more. Present yields in water benefits from the forest lands can be increased considerably by intensive control commencing at the catchment area.

Fully financed and completely integrated multi-purpose administration will automatically provide proper water management on publicly-owned watersheds. But single-purpose pressures and demands for functionalized forest land projects and uses too often defeat the aims of the administrator. So water must be recognized as one of the resources whose benefits can be augmented by expenditures for development as well as protection. At the same time it must be recognized that water strata like mineral veins ignore land boundaries.

Returns on water cannot be evaluated at the forest boundary. The full return can be determined only when the water has completed its maximum cycle of use and is about to be drawn back to the atmosphere. Likewise, one drop of water looks like another at the stream mouth, so whether it was caught on public land and performed its principal duty on public land or was caught on private land and irrigated the forest crops on public land is indeterminable.

Water management on forest lands must be comprehensive for the watershed as a whole, dealing with water where it courses, irrespective of who owns the land on which control measures may be required.

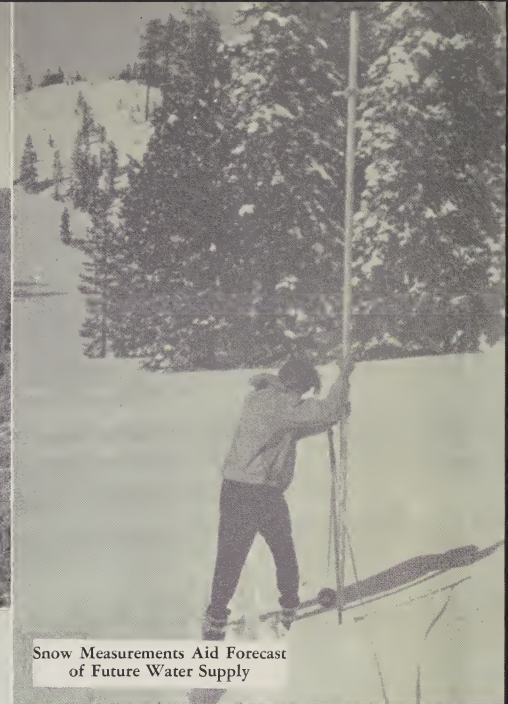
Water performing maximum duty will serve many uses between precipitation and evaporation. In this cycle it may travel far from the spot where it fell. The water from the forest lands of the Pit drainage leaves the power house of Shasta Dam to aid in salinity control of the lower San Joaquin or helps to produce Central Valley cotton before it floats flat tops on San Francisco Bay. Water that supports fish life, irrigates mountain meadows, and produces timber on the east slopes of the Sierra, may be used in generating steam for Los Angeles industrial plants before it returns to the clouds. A goodly portion of the recorded 67-million-acre feet run-off from California watersheds travels many a mile in supporting California economy.

Water management is not a localized problem. Ultimate demand is often far from source of supply. Water management on the forest lands of northern California must recognize the demands of Central Valley agriculture and southern cities as well as those of local hydro plants and forest crops. Management plans, therefore, must be integrated for the forest land watersheds over all the State.

In water management the emphasis should be upon the closest possible regulation of the entire catch of water from the time it falls as rain or snow until it has performed an optimum of duty. Water differs widely from other forest land resources. Put to work, it loses nothing in substance, form, or basic quality through continuing use. Uncontrolled, it may literally evaporate into thin air or it may become an agent of destruction. Water cannot be left alone; it must be regulated. It can be put to work or it can be walled in so as to render it harmless but useless. Under the first plan it becomes an asset; under the second, a liability.



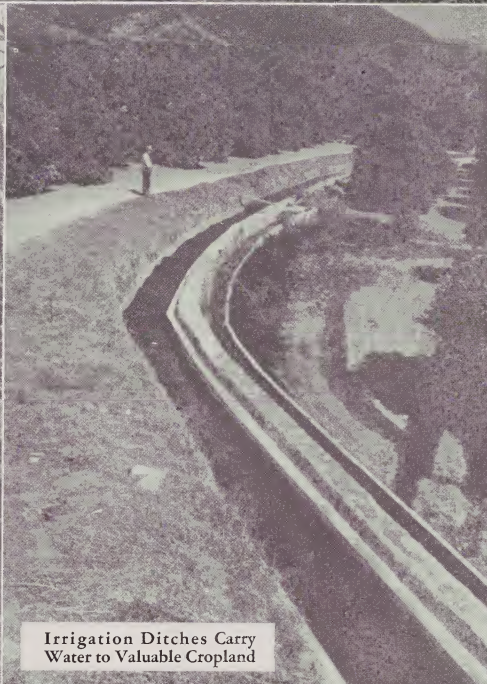
Typical National Forest Watershed



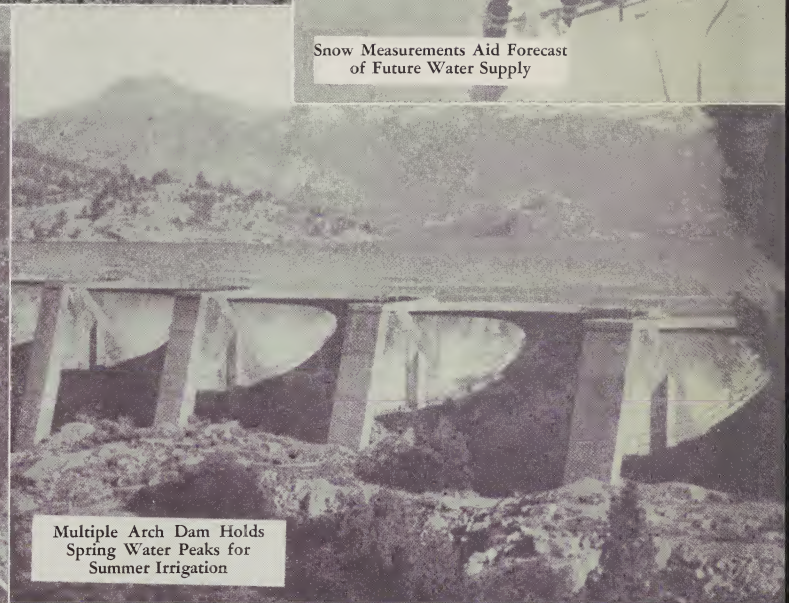
Snow Measurements Aid Forecast of Future Water Supply



Checking Effectiveness of Emergency Cover Crop Sown to Prevent Erosion on Burn



Irrigation Ditches Carry Water to Valuable Cropland



Multiple Arch Dam Holds Spring Water Peaks for Summer Irrigation



Barriers Spread Water Thus Increasing Seepage Rate Into Underground Reservoirs



Rock and Brush Gully Plugs



Simple Structures Are Effective in Erosion Control



Pole Dam to Raise Water Table in Mountain Meadow



Terracing for Retention of Runoff Helps Reestablish Cover and Control of Severe Mountain Erosion

Recommendations

The plan for a post-war water management program proposes to capitalize on sixty to seventy-five percent of California's precipitation caught on forest lands by reducing waste due to uncontrolled run-off and evaporation and obtaining the maximum possible upstream use through the growing of forest crops and generation of power; through vegetative, mechanical, or structural measures, to divert as much water as possible to underground storage, maintain firm stream flow for wild life and recreation, and to facilitate downstream regulation; to retard flood flows by augmenting watershed cover, reducing erosion, stabilizing channels, using vegetative and structural measures as necessary, or, in rare instances, providing open reservoir storage; concurrently integrating upstream management with regulatory measures proposed by downstream users and managers.

Projects specifically proposed as Water Management, and not a part of any program planned in connection with other forest land activities, are:

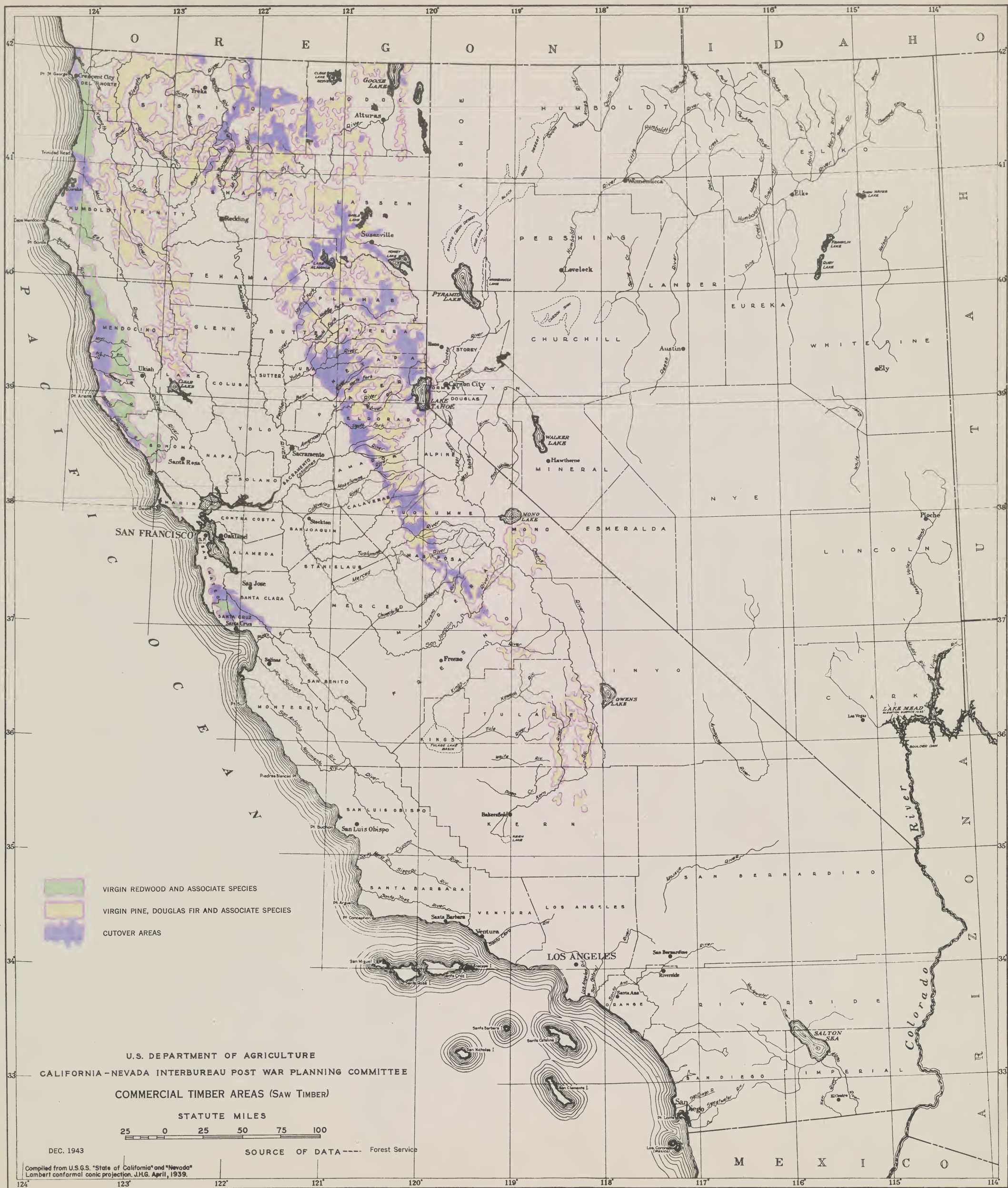
1. Headwater and intermediate reservoir storage and spreading grounds.
2. Cover improvement planting.
3. Elimination of pollution, resulting from both man-made and natural causes.
4. Channel stabilization and control measures involving both vegetative and structural measures, clearing cleanup, planting checks, and alignment.
5. Leveling and stabilization of mining debris.
6. Erosion survey, inventory, and control measures based thereon, for all classes of erosion which are not corrected by other resource management practices. These will include correction and rehabilitation of lands damaged by both sheet and gully erosion caused by past neglect or malpractice in mining, grazing, logging, and construction, and which cannot be justifiably financed from funds allotted for management of other resources or maintenance of roads and trails.

Water Resource Inventory

The initial post-war project, however, is a water resource inventory. An imposing array of statistics is available on run-off at the edge of the forest lands; current water power output, irrigated crop production, and municipal water use; and for the estimated potential requirements. Total catch of rain and snow and potential yield in usable water from forest lands are now hardly more than guesses. Too much emphasis cannot be given to the need for the collection of this information before really tackling the job of water management.

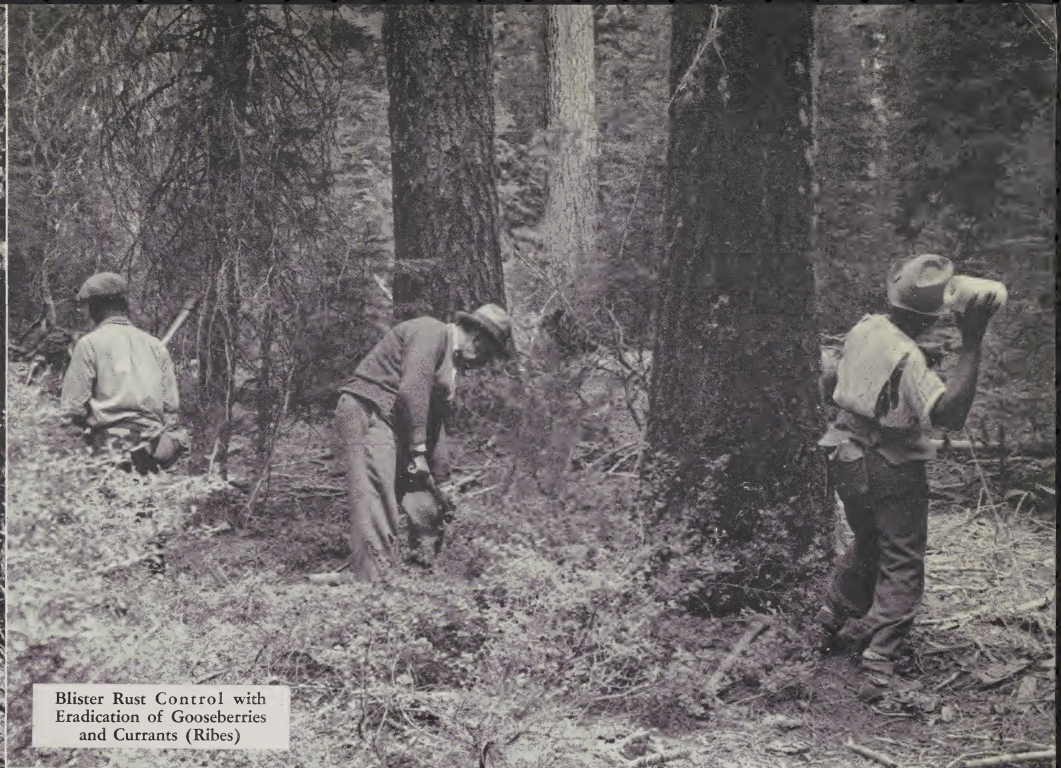
Other Recommended Projects

Many opportunities for augmenting use of water, stabilizing firm stream-flows, and regulating run-off are and will be readily discernible without the data to be supplied by the inventory. Numerous projects in this class have received a preliminary examination and are now ready for engineering surveys. Ultimately, as the State continues to grow, many plans for the better husbanding and more intensive use of water, which now seem fantastic, will ultimately be justified on California forest lands.





Sugar Pine Doomed Unless
Blister Rust Controlled



Blister Rust Control with
Eradication of Gooseberries
and Currants (Ribes)



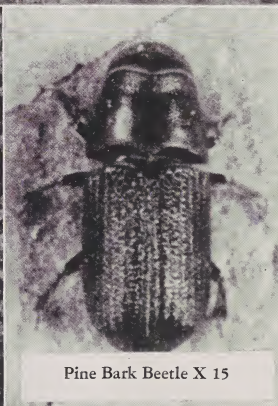
Salvage of Trees Susceptible
to Destruction by Insects



Porcupine Damage Many
Young Pine Stands



Destruction by Pine Bark
Beetles



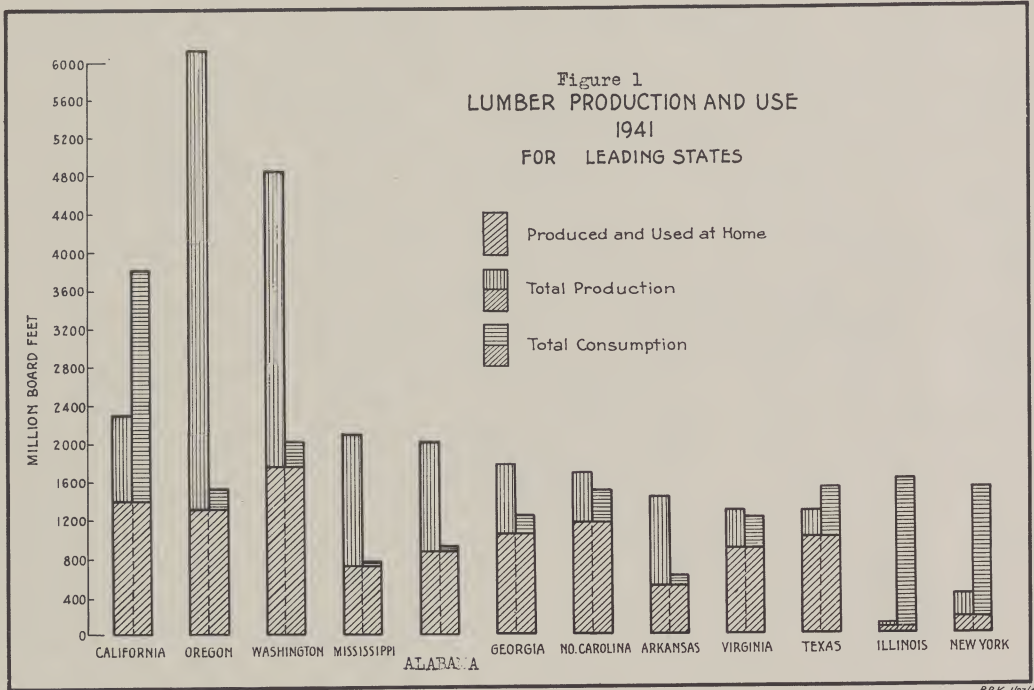
Pine Bark Beetle X 15



Marked Trees Susceptible to
Insect Attack. Note Estab-
lishment of New Forest

General Statement of the Situation

California ranks first in the nation as a consumer and third as a producer of lumber (Figure 1). Demands for lumber and other wood products may be expected to increase within the State with the continued upward trend in population anticipated with future industrial development. On prewar levels as comparable base, California production supplied less than 50% of the local demands, thus necessitating imports from Oregon and Washington for the balance. At the same time, 800 to 900 million board feet of high quality lumber produced here have been shipped to other states (Figure 2). The rapid depletion of merchantable stands in the North Pacific Coast leaves the alternatives of more dependence on local resources or the development of substitutes to supply future needs. More pressure to export to non-producing areas may be expected after the war, which will increase competition with local markets.



Timber in the State Economy

One-fifth of the total area of the State is suitable for timber production. Six species--redwood, sugar pine, ponderosa pine, Douglas fir, white fir, and incense cedar--grow in commercial quantities and are used for many purposes, ranging from high grade airplane, veneer, and pattern stock to the more common posts, poles, crating, and fuelwood. In 1941, before the war demands were noticeably felt, the amount of lumber used locally totalled 3,836 million board feet or 542 board feet per capita. Agricultural needs include not only wood for houses, barns, sheds, and fences, but also for containers to ship a variety of specialty crops.

The lumber and allied wood using industries have contributed materially to the state economy. Their total capital investment is considered 500 million dollars, which in 1939 produced about \$115,500,000 in wood products. They employed during the same period 32,400 workers who received more than \$93,000,000 in wages and salaries. The survival of 80 or more towns and rural mountain communities depends primarily upon this source of employment. Before the war, the common carriers in the State transported 11 to 12 million tons of timber products. Timberlands also provide the principal source of revenue from the property tax in the mountain counties.

History of Timber Development

The development of the lumber industry in California did not begin until after the discovery of gold; this momentous event, incidentally, having occurred in the process of establishing a small sawmill. With liberal land laws laxly interpreted, accompanied by large railroad grants, it was not unusual for private owners to acquire large blocks of timber, especially with the foreseeable exhaustion of the supply in other parts of the country. By the time the National Forests were established, most of the high quality, accessible, heavy stands of timber were in private ownership. The reserved Government timber, rejected by private interests on account of its poorer quality or inaccessibility, has not as yet played much of an important part in the operation of the lumber industry, but it will in the future.

To date, more than half of the original merchantable timber in the State has been cut. Census figures, not too accurate for the early years, show a total cut of 80 billion board feet, of which 6 billion, or 7½%, came from public lands administered by the Forest Service. With the exception of four years, the production has been over 1 billion annually since 1904, and for the past 3 years has exceeded 2 billion.

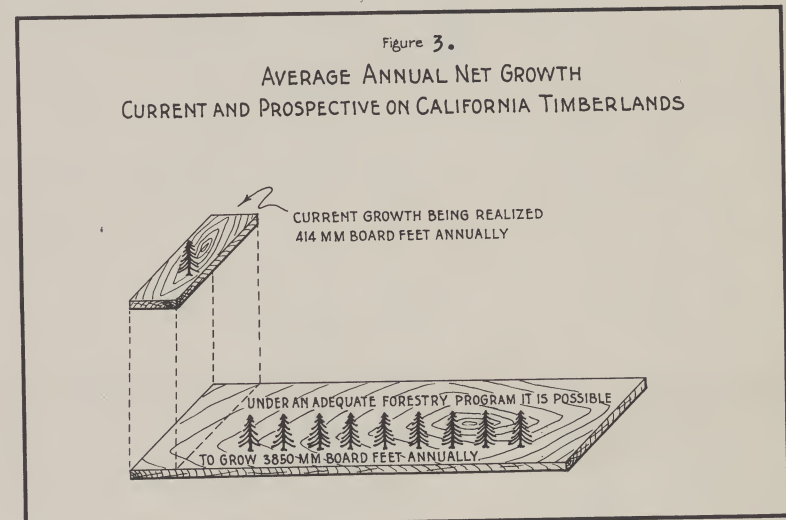
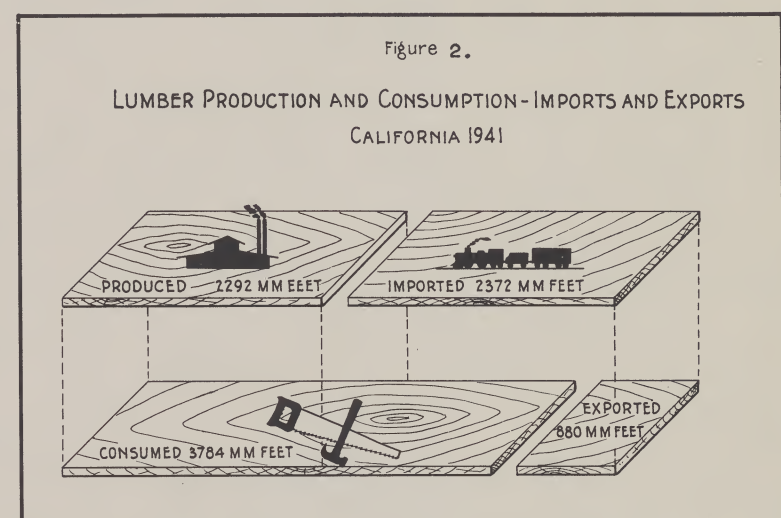
The earliest logging was done by hand and with horses or oxen to remove only the best quality trees (hi-grading), and in itself was not too destructive. With the advent of steam power, production went on a quantity basis. Establishment of logging railroads and larger mills increased the capital investment and to a great extent forced a liquidation policy of privately owned timber. Clear cutting was a common practice, and any trees left standing by the fallers were more than likely to be knocked down in the process of logging by the skidding lines. Eventually it was discovered that this method was also destructive of equipment, and damage was partially reduced. The tractor offered opportunities to log only the profitable trees, and some advancement was made in determining economic sizes, but heavy investments still indicated liquidation, and even the more advanced operators have now returned to heavy cutting under the pressure of war prices.

The Forest Service has followed a policy of selective cutting throughout its history in California; even in the days of steam logging at least 20% of the volume in the younger and thrifter trees were left as a reserve or for seed purposes. Current practices now in effect provide for retention of about 35% in the average reserved stand, although in some cases of salvage character 65% is retained.

The cutover privately-owned lands have, in many instances, been left in such poor condition that only a small fraction of the potential tree growth is being realized. Felled trees have been only partially utilized, and the debris caused by limbs, tops, broken material, and damaged reproduction has created a heavy fire risk. Nearly all of the earlier privately-cutover lands have been burned over, and where seed trees were not available, soil values have deteriorated and dense brush fields become established. On heavily cut, but unburned areas--and the public lands are not excepted in this instance--the sudden opening up of the stand has favored the invasion of brush species with much the same effect as fire.

Prospective Demand

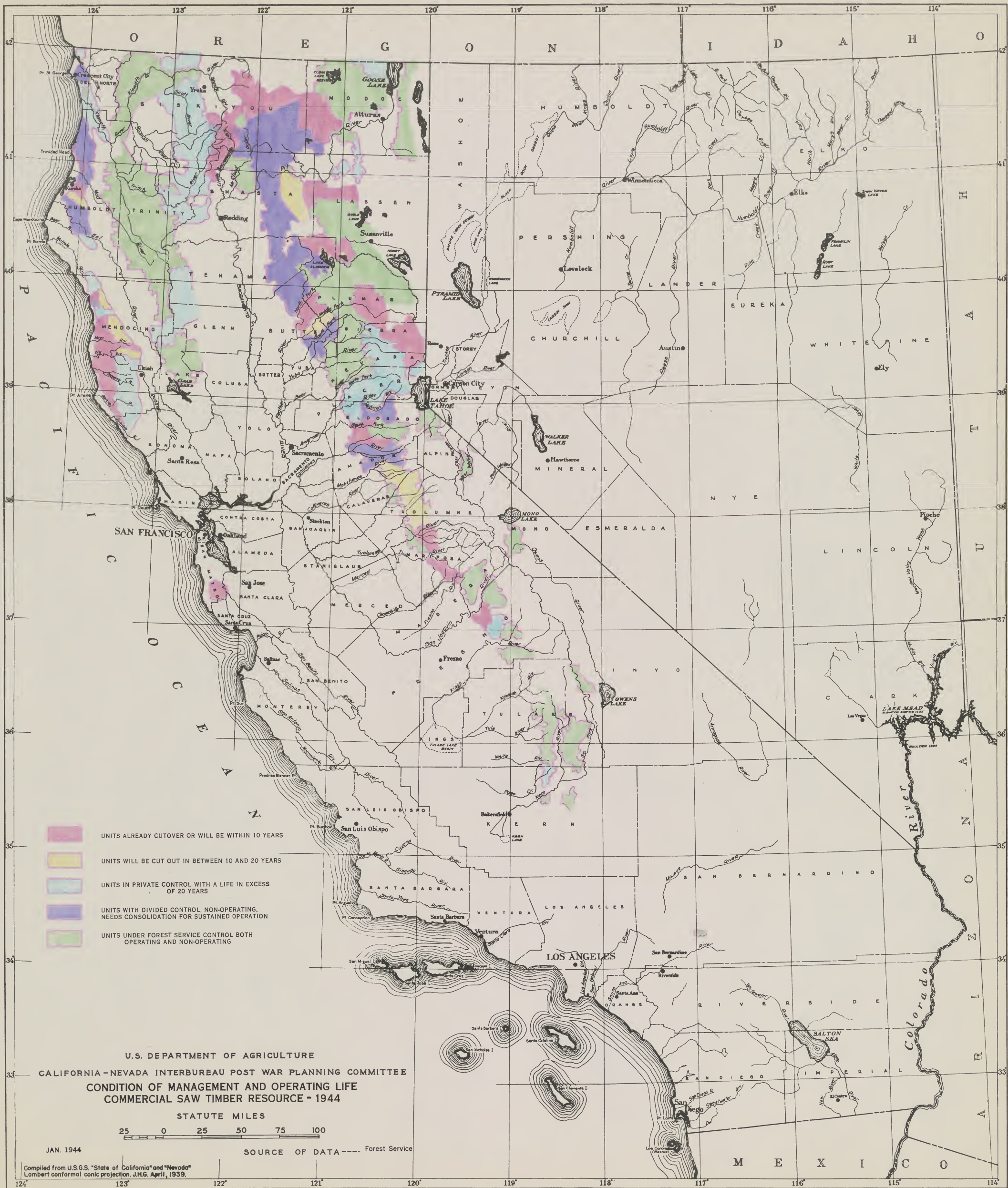
The anticipated demands for wood after the war are expected to far exceed, both in scope and quantity, anything that has occurred in the past. Innumerable new uses have been invented and are in the process of development, such as fabricated timbers, plastics, wood alcohol, acetone, and many others that will play an important part in our mode of living. It is not unrealistic to conceive the derivation of gas from wood to replace the diminishing supplies of natural gas and petroleum. If from only the standpoint of national defense, the renewable features of timber stands should bear current attention as a continual supply of usable raw material.



Present Conditions for Timber Production

California faces the future with only 7,800,000 acres of commercial virgin timber, inclusive of both the redwood and pine region (Figure 4). The ownership pattern consists of 70% in Government holdings, on which a large proportion of the timber is uneconomical to utilize under present conditions, either on the basis of composition in the stand or accessibility. The total area of cutover lands equals some 11,900,000 acres, of which 5,200,000 acres are restocking to some degree, and the remainder is in a non-productive condition, mostly covered with brush (Figure 4).

The outlook towards permanence and stability of existing lumber producing centers is far from encouraging. The production of 50 odd sawmills provides over 90% of the present total annual cut in the State. Twenty of these operations (25% of the total annual cut) face dismantlement or moving to new and less desirable locations within the next 10 years, due to exhaustion of their local timber supply. Eighteen communities will lose their major source of income within 10-15 years and at least 10 of these will probably be completely abandoned. The effect of these losses to mountain communities as a source of employment as well as taxable property is self-evident.





Forest Nurseries Provide Seedlings for Reforestation



Planting



Successful Planting of Brushfields



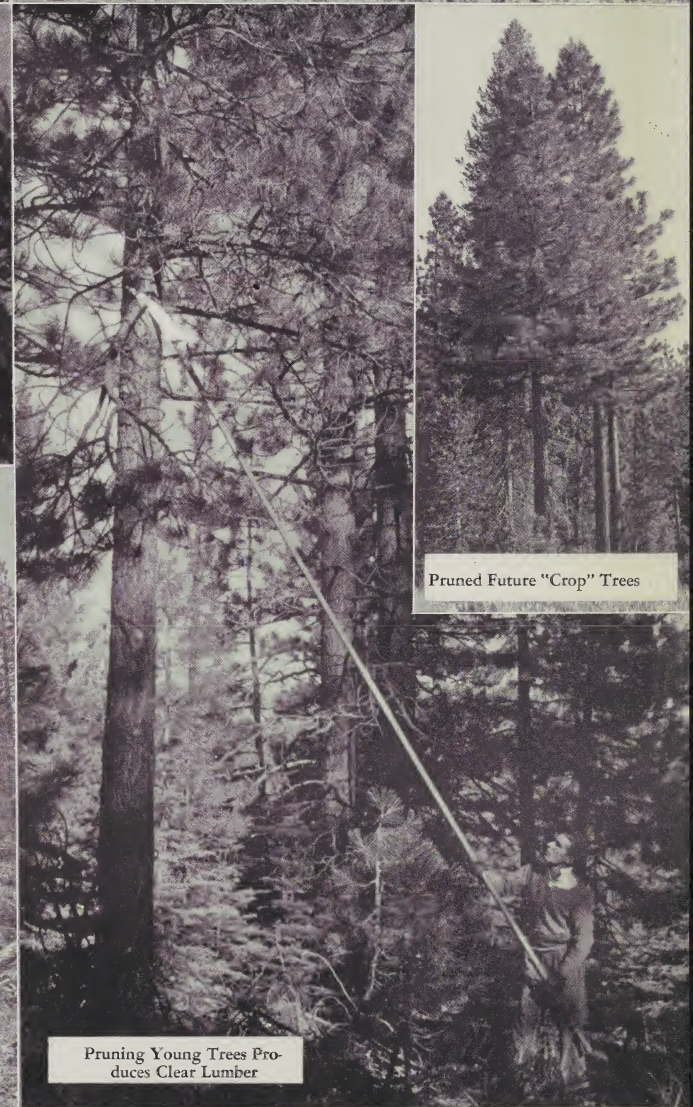
Necessary Stripping of Brushfield for Planting



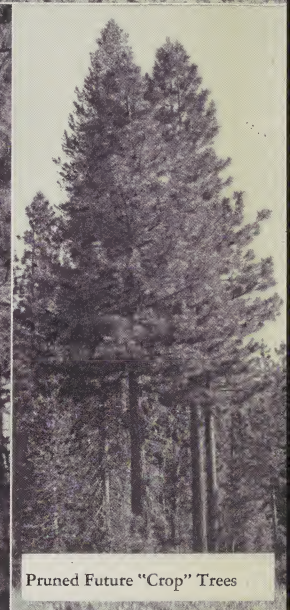
The Future Timber Crop



Wasteful Logging



Pruning Young Trees Produces Clear Lumber



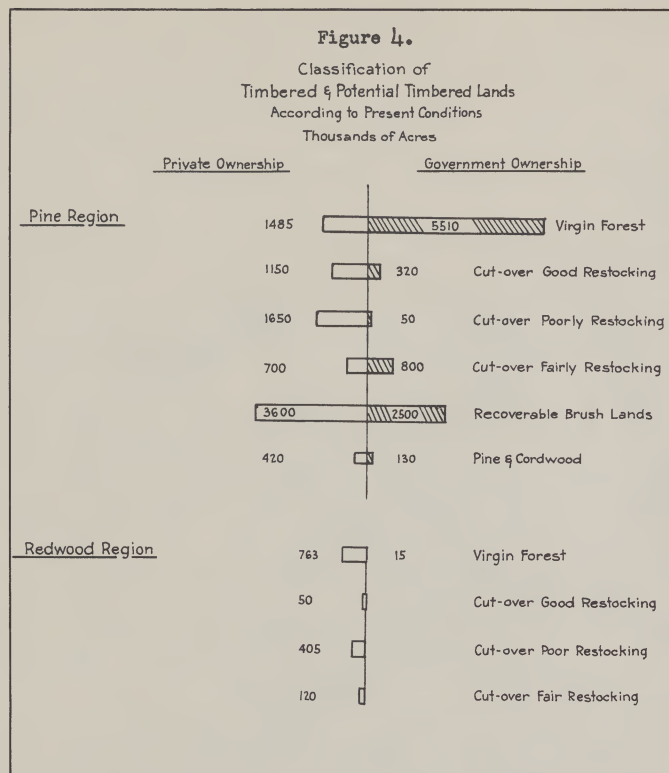
Pruned Future "Crop" Trees



Young Stand Needing Thinning



Same Stand Thinned to Produce Maximum Growth



There are sufficient timber producing lands capable of supplying most of the local needs if present conditions are fully appreciated and necessary measures undertaken soon. The use of known cultural practices on 16,600,000 acres of the better growing sites should assure production of at least a net annual growth of 230 board feet per acre, or a total slightly over 3.8 billion board feet (Figure 3).

Any attempt to successfully attain a reasonable degree of sufficiency on a permanent basis must be started immediately. Within the next 35 years, the remaining virgin stands will be cut over, and it will then fall to the existing second growth stands to carry the load during the adjustment period.

Losses from Fire, Insects, and Diseases

Fire

Although the advancement made in this field of protection has far exceeded the efforts to reduce losses from insects and diseases, there is still need for expansion and improvement. The establishment of protection roads, removal of dead trees and snags, and the partial or complete disposal of debris are some of the types of projects in fire control needing further work to develop adequate protection to safeguard the timber stands.

Insects

In some localities, the pine bark beetles have been as destructive as fire or logging. From 1926 to 1940 in northeastern California, they destroyed over 11½ billion board feet in standing timber, while during the same period the lumber men cut 10½ billion board feet. An endemic condition has more or less existed throughout the pine belt, from which there have come cycles of increased numbers to epidemic proportions in particular areas, independent of one another. Sometimes these intervals are 10 to 15 years apart, but when they occur, the kill in the timber stand is exceptionally heavy. The work of the beetles is just beneath the inner bark, which will usually kill the trees within a few months after attack. If this material is not removed and salvaged within a year it becomes a total loss.

During recent years, considerable progress has been made to identify trees which are apt to be attacked. The removal of these high risk trees before attack eliminates the chief attraction as well as enables the utilization of the timber. A light cut by a logging operation, taking these highly susceptible trees, is recommended as a preventive measure against pine beetle epidemics.

Disease

Blister rust is the major threat to the younger sugar pine and the other five-needle pines. The disease has now strongly established itself in this State, having migrated southward from the Pacific Northwest. The infecting organism enters the tips of the needles and works down the branches to the bole, gradually killing the tree. A saving feature is that the rust must spend one portion of its life cycle on shrubs of the Ribes species (gooseberries or currants), and an elimination or heavy reduction in number of these plants can effectively stop the spread. The transmittal from Ribes to pine also cannot occur over a distance in excess of a few hundred feet, which permits definite limits of control to be set around areas selected for protection.

Sugar pine is known to occur in varying degrees of mixture with other coniferous species on about 3 million acres in California. Of this area, about 1,800,000 acres have been selected as being of sufficient commercial value to warrant blister rust protective measures.

From 1933 to 1940, inclusive, large-scale Ribes eradication operations were carried out as a function of the various work-relief programs. Since 1940, the program has been limited to maintenance of 600,000 acres already worked.

Other Diseases: Large areas of Douglas fir and white fir, which represent a strong portion of the remaining virgin timber supply, are afflicted with diseases which cause a decomposition of the heart wood. This damage is so extensive in some localities that it is questionable whether these stands can be operated on the basis of adequate financial return. Public assistance should be provided to find ways to combat these destructive forces and cooperate in a program of utilization involved in their rehabilitation.

Action Necessary to Meet the Prospective Timber Demand

A complete State-wide, cooperative timber management policy is a prerequisite for an effective program.

This policy should guarantee the maintenance of a high degree of productivity from all timber-producing lands, private and Government alike. It should provide Governmental control through ownership or consolidation where private interests cannot be expected to undertake adequate productive measures. It should protect the forested lands from fire, insects, and disease. It should provide for extension work with various landowners, including the large and complicated field of utilization. It should provide for forest planting on Federal and private lands and for legislation covering the fields of taxation and sustained yield. In more detail, such a program involves:

A. Assemblage of basic inventory data. Includes the preparation of topographic maps from aerial photographs as well as the collection of data on vegetative cover, timber growing capacity of the soils, condition or absence of growing stock, volume and quality of timber, logging plans, etc.

B. Acquisition. A plan of action to select and acquire those existing and potential timber producing lands where private interests cannot be expected to conduct desirable forest practices.

C. Establishment of community and demonstration forests. A minimum of a demonstration forest for each county is needed, and a community forest where local residents can actually participate is preferred, as a means to develop a keener appreciation of good forest management practices.

D. Adequate program of forest research. Tools are needed with which to do the management job effectively and efficiently. A few problems requiring study are: slash and snag disposal, efficiency of various woods equipment with logging operations, factors of cull and breakage, nursery techniques and forest genetics, etc.

E. Develop means of utilizing waste connected with present day logging and milling practices; uses for inferior or weed species; techniques in salvage of damaged and high risk trees.

F. Collection of seeds and establishment of nurseries. Planting requires in California two to three year old stock grown in forest nurseries to attain satisfactory survival. To meet the needs and be ready for any extensive program, several nurseries should be established now, scattered over the State, with a total capacity of 40-50 million young trees annually.

G. Establishment of young seedlings on non-stocked or understocked areas. The presence of brush sets up strong competition for moisture with newly planted trees and provides a native habitat for a diversified rodent population which eat tree seeds and succulent tips and bark of young seedlings as a part of their diet. This situation requires the removal and control of brush in strips or in laid out plots supplemented with rodent poisoning and possibly screen covering over the young trees for several years to give them the opportunity to become firmly established.

H. Treatment of larger trees.

1. Thinning - removal of competitive trees and shrubs from around selected future "crop trees" to concentrate growth picked for future cutting.
2. Pruning - removal of dead or green limbs from the lower portion of the bole of selected future "crop trees" to grow superior quality of timber free from knots and other defects.

I. Legislative Program. To accomplish the objectives set forth, a legislative program should be sponsored to provide:

1. Public control of cutting practices on private lands.
2. Extension of boundaries and authorizations with funds to acquire lands for public ownership, where private interests cannot be expected to carry on desirable forestry practices.
3. Authorization with funds to undertake necessary fire protection and planting on private lands.
4. Provide an equitable payment to counties for Government holdings in lieu of taxes.

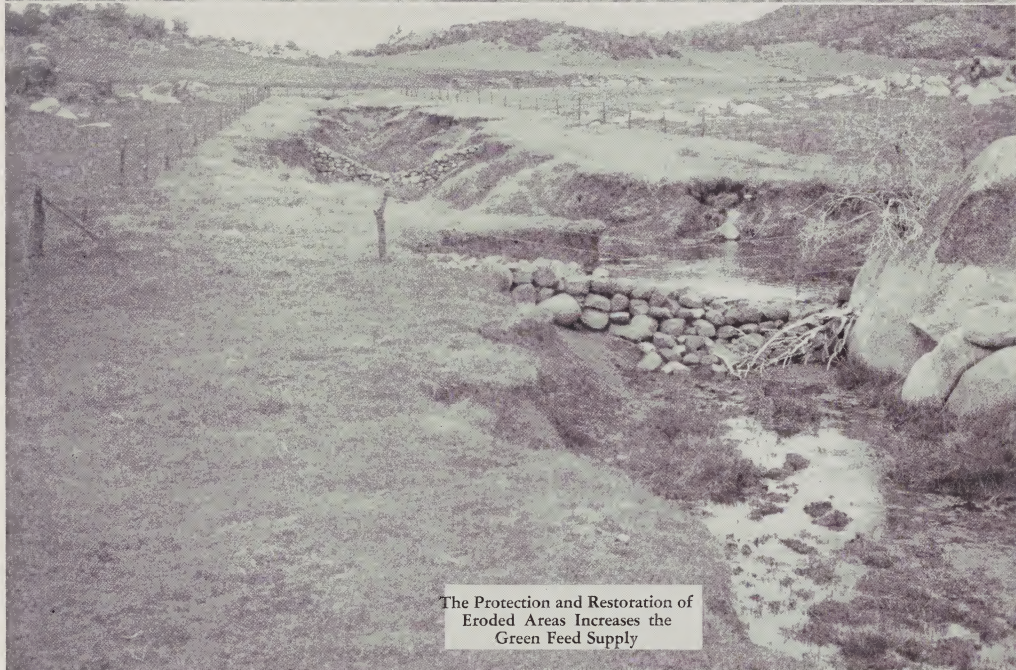




The Shortage of Green Summer Feed Is a Bottleneck in California Livestock Production



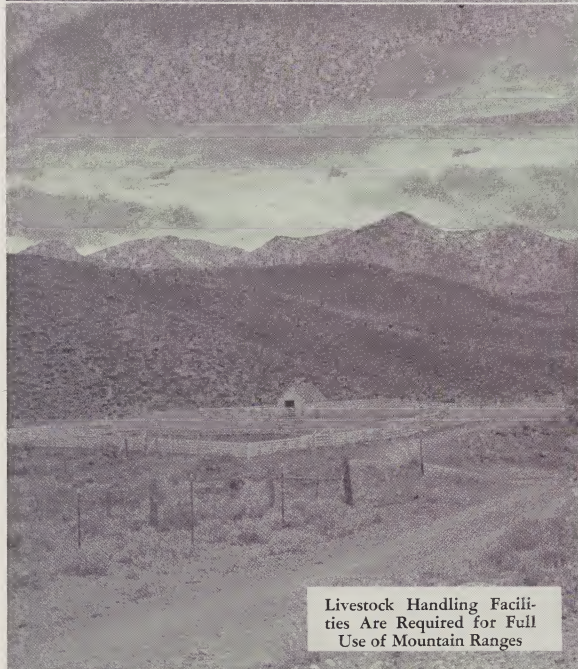
Increasing Forage Production on Good Mountain Meadows Is Essential



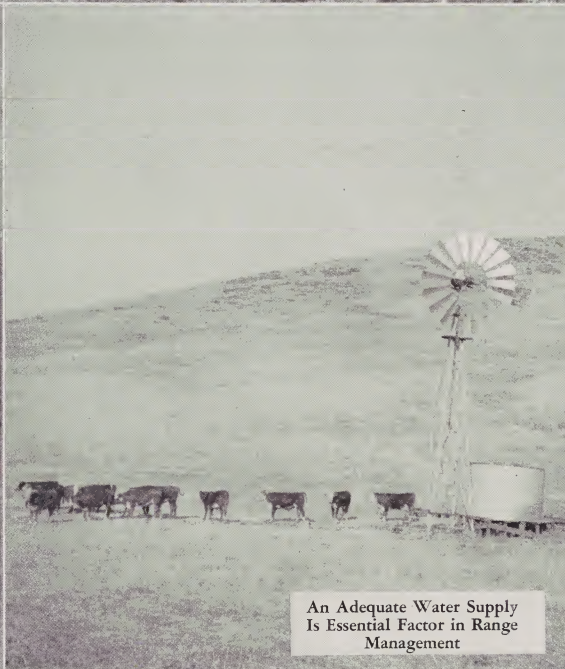
The Protection and Restoration of Eroded Areas Increases the Green Feed Supply



The Conversion of Chaparral and Woodland-Chaparral to Grassland Is Often Feasible on Good Soils



Livestock Handling Facilities Are Required for Full Use of Mountain Ranges



An Adequate Water Supply Is Essential Factor in Range Management



Productivity of Mountain Ranges Can Be Improved by Reseeding



Irrigated Pastures Furnish Fattening and Finishing Feed for Range Livestock



Valley Ranches and Mountain Ranges Are Intimately Related

FOREST-RANGE LANDS

The Economy of Livestock Production in California

The successful operation in range livestock production hinges largely upon a balance of seasonal forage of high value throughout the year to insure rapid and continuous growth of the livestock and a finished quality to the animal products.

In this State there is an excess of late fall, winter, and spring green feed in comparison to the supply available for summer grazing. The nutrients disappear with drying and the use of such feed results in loss of weight, increased requirements for special feeds for finishing, and potential reduction in the natural increase in young stock. Furthermore, such use also limits the number of livestock a ranching unit can economically support. At present, local meat production is only two-thirds the local consumption.

Three possible alternatives exist to adjust the effects of an unbalanced ratio of green range forage. One deals with the restoration and development of range resources in the mountains for summer range by improvement of forage and the construction of necessary facilities for more intensive use. Another is in the production of summer feeds and concentrates on the higher priced irrigated and other valley lands, and a third on the relegation of the industry to a feeder basis.

The Contribution of Forest-Range Lands

The forest land area, exclusive of National Parks and National Monuments, contains approximately 24,000,000 acres of good permanent range. It lies at the higher elevations in the Sierra-Nevada Mountains above the commercial timber belt. A thin narrow strip extends intermittently along the coast line from Santa Cruz north to the Oregon line, while throughout the inner Coast Range it is found above the 3000 foot elevation. It is estimated that 30 to 40 percent of the grazing capacity is centered in mountain meadows, moist streamside types, and swales which, in reality, constitute a very small proportion of the total area. These key tracts in many cases control the utilization of surrounding lands, due to their high grazing value and a more abundant water supply.

There are, in addition, 6,000,000 acres with fairly high temporary grazing values. Good feed is usually available on the timber growing sites for several years after a stand of timber has been opened in the process of cut-over. As the small young growth comes in, often to the degree that stock cannot readily pass through the new stand, the grasses and shrubs are gradually shaded out and disappear. On the remainder of the forest land the grazing value is either too low for economic use or is non-range in character.

The grazing period on the mountain ranges is usually for 4 to 5 months over the summer season. The National Forests in the State carry approximately 150,000 head of cattle and 330,000 sheep; the principal means of support for 1500 families and partial support for an additional 2000 families. These livestock normally produce an annual income of \$3,500,000. Surrounding adjacent privately-owned ranges support an additional but smaller number of stock during the same season.

Character of Early Use and the Relationship to Present Conditions

Range use in California began with the introduction of domestic livestock in the southern part of the State by the Spaniards. By the middle of the nineteenth century, range cattle covered most of the Sacramento and part of the San Joaquin Valleys. The cattle industry prospered with the increased population attracted by the gold rush, and sheep were introduced in large numbers from the Middle West. The severe drought in 1863 forced the livestock owners to seek range and pasture in the mountain areas. This use continued and by the turn of the century most of the mountain ranges were being severely overgrazed in the struggle between individual owners as well as between the cattle and sheep industries for forage. During the last 25 years of the nineteenth century, livestock numbers reached their peak.

Primitive methods of husbandry were the rule. The livestock business returned profits to the operators on the basis of exploitation practices. Management was rarely efficient and seldom planned for the highest use of the resources. Private ownership centered around water holes, meadows, and key tracts that would control surrounding public range. As a result, depletion occurred to a greater degree on the private than on the public lands; in some cases the remaining residual values were left in such condition that rehabilitation can only be achieved under public ownership and management.

The establishment of the National Forests arrested depletion and permitted recovery on some areas; yet, because of lack of full-scale facilities to control livestock and to aid nature in the job of rehabilitation, these ranges are still far from being fully productive.

The development of the various uses of the mountain area has adversely affected range values in several areas. The protection of forests from fire has resulted in timber reproduction crowding out desirable forage over a wide area. Undesirable tree species have invaded the dryer areas of mountain meadow where early overgrazing provided ideal seedbeds. New livestock driveways have had to be provided with the construction of high-speed highways through the mountains, to eliminate the hazard to both traffic and livestock. These improvements and the modern automobile have encouraged large numbers of people to come to the mountains for recreation; and where concentration of this form of use exists, the exclusion of livestock is required.

The Major Problems in Management of Forest Range Lands

The mountain ranges are particularly susceptible to damage. They comprise typically, steep, unstable soils, with the vegetation in critical balance. With dry, severe, summer climate, recovery has been slow under any situation, and imperceptible on depleted soils. With varied topography and mixed forage types tending to cause uneven use and widespread damage in the more favored and accessible areas, overstocking with numbers and grazing at wrong seasons of the year have resulted in denudation of key areas and all but disappearance of many of the principal forage species.

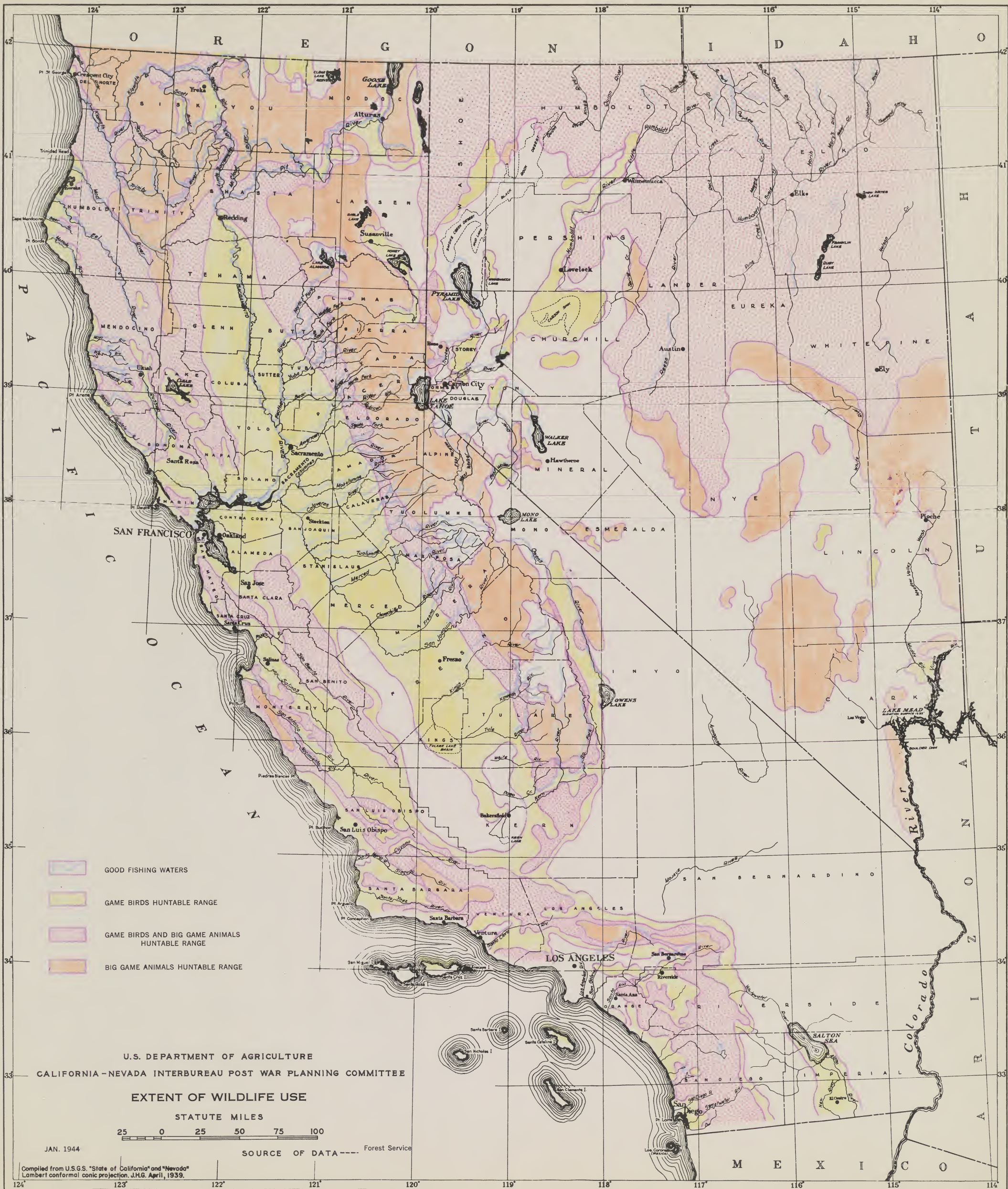
Briefly, these problems are:

1. Many ranges are far from being fully productive and therefore not producing the amount or quality of livestock products needed.
2. Insufficient management facilities exist for (a) full utilization of existing forage resources; (b) timing grazing use area by area for maximum return; and (c) handling livestock economically either on or to and from ranges.
3. Lack of full coordination of use between (a) mountain ranges, (b) valley range, (c) maintenance and finishing feeds produced as crops, by-products, or aftermath of developed agricultural lands.

Accomplishments with Intensive Management

In planning the application of an intensive range development program, it is desirable to delineate by classes of land the conditions where different degrees of intensity are justifiable. Recommendations include:

1. Abandon as range low value areas not likely to yield a profitable return even with development.
2. Installation of only simple management facilities on timber growing sites considered of good quality range for only a few years after the harvesting of a timber crop.
3. Full scale development on good, permanent range lands. Scope of program:
 - a. Rehabilitation of abused areas, through erosion control, fencing, etc., to restore full natural productiveness. On the better sites, the introduction of better forage species to increase natural capacity, through reseeding, water spreading, and irrigation.
 - b. Development of water supply, drift fences for controlled grazing, and other necessary facilities to obtain full use and maximum forage values.
 - c. Construction of driveways, corrals, chutes, etc., for most economic handling of livestock.
 - d. Adjustment of grazing use to the local economy for the greatest public good.

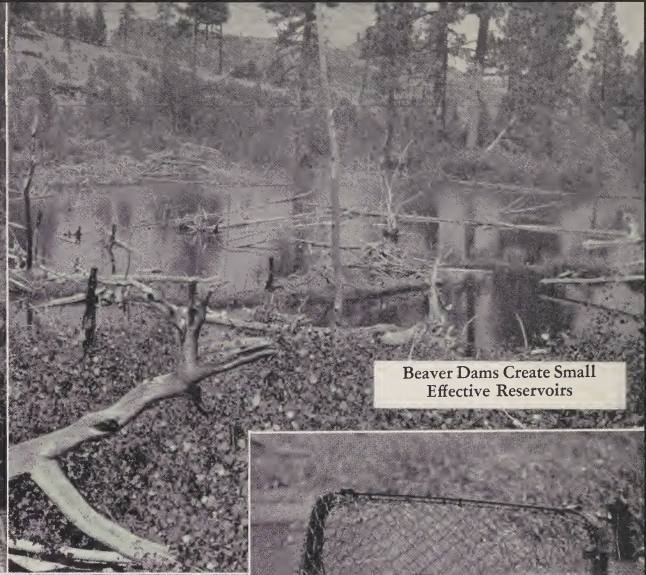




Improvement of Streams for Fish



Fish Screens Reduce Losses in Irrigation and Mining Ditches



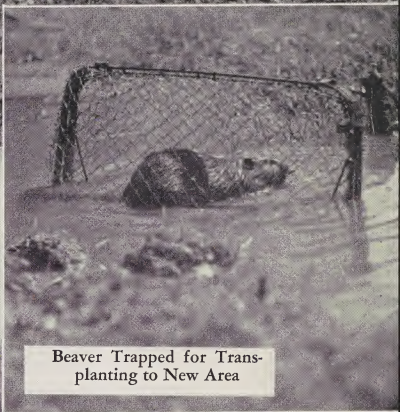
Beaver Dams Create Small Effective Reservoirs



Deeper Pools on Swift Streams Improve Habitat for Fish Life



Forest Lands Are the Natural Habitat for Deer



Beaver Trapped for Transplanting to New Area



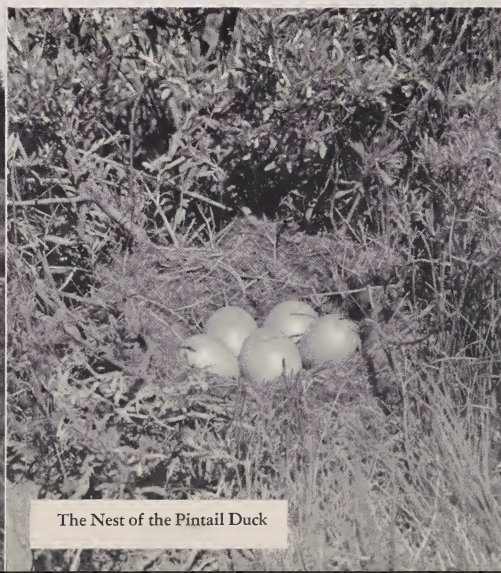
Young Mallards Learn to Swim



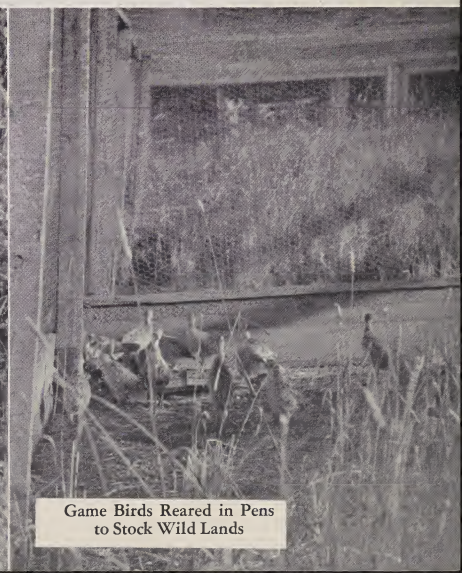
Many Canada Geese Nest on the National Forests



Developed Feeding and Nesting Grounds for Migratory Waterfowl



The Nest of the Pintail Duck



Game Birds Reared in Pens to Stock Wild Lands

WILDLIFE MANAGEMENT

Wildlife - A Land Resource

Forest lands in the State provide a home for many wildlife species. They grow food and cover for game animals and upland game birds. They supply water to the rivers, streams, and lakes for fish life. They furnish scattered intermingled ponds and marshes that are used for nesting grounds by ducks and geese.

As with other resources, wildlife has severely suffered from exploitation. Feeble attempts have been made at remedial measures. The chance for success has often been reduced by the delay in taking positive action. Perhaps the most serious failure in wildlife conservation has been in misdirection of effort toward regulation of the sportsmen rather than toward restoration of the environment.

The Need for Wildlife Management

Hunting and fishing are a cherished form of relaxation in American life. In this State each serves as a healthful means of recreation, enjoyed by 150,000 hunters and 250,000 anglers each year. Present numbers and limited distribution no longer give the sportsman a reasonable chance for success. The need for an expanded opportunity for hunting and fishing grows greater each year, while the trend is toward the acquisition of property or rights on valuable game areas and streams by groups financially able, thus further restricting the opportunity of the unattached sportsman. Many of the native species of huntable game have disappeared. The more prolific have generally held on, and those which have been able to adjust themselves to man-made changes in environment, such as the deer, have shown some increase.

The settlement of rural lands and early exploitation of wildlife in the more accessible areas have required the sportsmen to go farther and farther into the back country. To begin with, the habitat that nature provided in many areas was far from perfect. At best, many of the 12,000 miles of fishing streams and 10,000 mountain lakes can be classed as only mediocre when comparing the total catch to the amount of fishing effort. The really fine spots are the secrets of the rugged anglers who enjoy the privacy found away from the "beaten path."

Commercial fishing for salmon is an important industry along the coast. The value of the catch exceeds \$1,000,000 annually.

Destructive Influences

Increased concentrations of people in the rural areas have reduced the area of natural wildlife ranges. The regression of forested lands to brushfields, the overgrazing of range lands, and the misuse of fire have had their effect in destroying the capacity of the native environment to produce wildlife. The same effect resulted from single-use types of management, such as timber production, where the elimination of the oaks and other broad-leaved species within a particular area materially reduced the feed to sustain wildlife. Outstanding as an example of the failure to recognize wildlife values has been the destruction of fish life in the management of water. Much of the original conditions has been severely impaired with the diversion of water for agriculture, mining, power, and municipal use. To make it more difficult for existence, streams have been blocked with the construction of dams, screens have not been universally provided at diversions, and adequate fish ladders have not always been installed around man-made barriers.

Trend in Plans for Management

Protective measures for wildlife were first focused upon the setting of hunting and fishing seasons and bag and creel limits. The next phase included the establishment of wildlife refuges, removal of certain species from the list of takeable game, and other restrictions to control the hunting effort and reduce the kill. The failure of these limitations to maintain the sport hunting and fishing desired stimulated interest in transplanting native species, introducing exotics, and artificial propagation of upland game birds and fish.

Little consideration has been given so far to the improvement of natural habitat, which, obviously, has affected the rate of drain on wildlife numbers.

The severe drought during the 1920's clearly demonstrated the necessity of swales and marshes in the feeding, nesting, and raising of young ducks and geese. The recognition of the value of habitat, followed by prompt action, has restored their numbers to where they are again important game birds.

Major Problems in Wildlife Management

From the standpoint of development of wildlife resource, the major problems may be briefly summarized as:

1. Restoration and improvement of natural habitat to attain maximum optimum conditions for game animals, upland game birds, water fowl, and fish life.
2. Integration of wildlife production with other necessary and desirable uses of the land and water.
3. Obtain fundamental scientific facts founded on biological principles to build progressive plan of management for wildlife resource.

Program of Remedial Measures

1. Technical services

- a. To protect wildlife values on all construction programs and to adjust practices in timber and on ranges and other resources to improve the wildlife habitat.
- b. To so harvest timber and forage, and to so use water that wildlife values are maintained or improved, and to emphasize wildlife values in the administration of certain key areas and aggressively inject consideration of wildlife needs into planning for forest crop production.

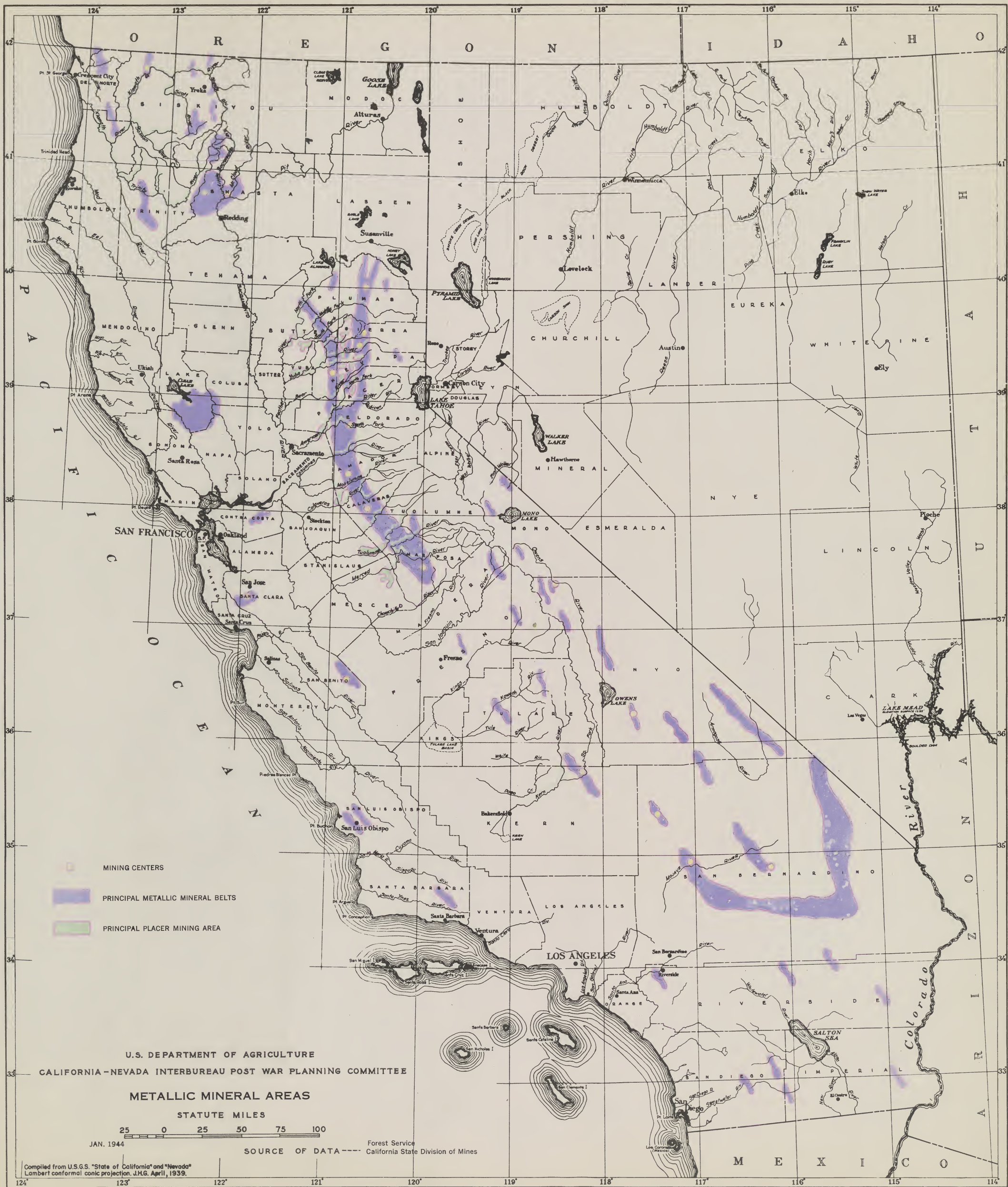
2. Installation of facilities needed to remedy imperfections in habitats.

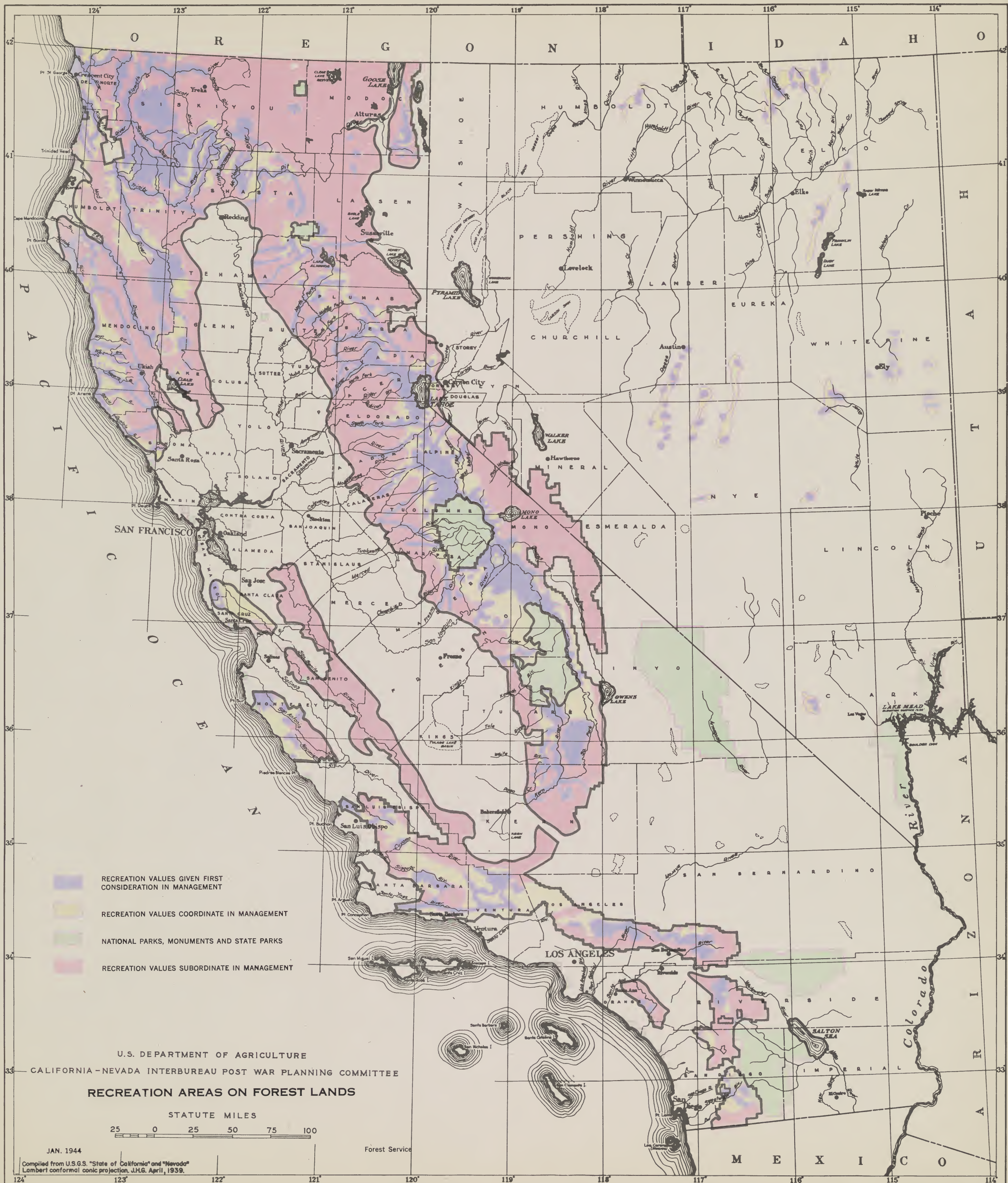
- a. Fish. Construction of small dams for regulating water flows; installation of fish ladders over barriers and fish screens; development of spawning areas, etc.
- b. Game animals and birds. Develop watering places, food and cover planting; provide interspersions of food and cover types; etc.

3. Reestablishment of desirable species and removal of undesirable predatory species.

- a. Beaver and antelope planting.
- b. Removal of rough fish.
- c. Construction of holding ponds for fish distribution.
- d. Construction of holding pens for game bird distribution.
- e. Predatory animal control.

The need for developing and managing wildlife cannot be questioned. The major opportunity lies in the full productiveness of the wild lands and waters. The job ahead is fairly well marked out. Research is needed for refining methods and practices.





RECREATION AND TOURISM
NATIONAL PARKS SERVICE
WASHINGTON, D. C. 20540
TELEPHONE (202) 341-6400
FACSIMILE (202) 341-6400

RECREATION AND TOURISM

MINERALS

The Need for Management

Minerals, as an unrenovable resource, should be subjected to management on the basis of maximum public benefit. At the present time the processes for extraction and refining ore or raw products have caused serious losses to other resources, such as the dredging of fertile valley lands for gold, and the silting of reservoirs with mine "tailings." Misappropriation--fraudulent or with honest intent--has frequently prevented the assignment to or development of higher public use. In many cases, mining claims have been located so as to extort fees for rights-of-way of proposed highways, or to gain control of a stand of merchantable timber, a recreational area, the shore along a fishing stream, or some such similar purpose. Such abuses are practiced under the guise of the mining laws but not by the real mining fraternity.

Importance of Mining in the State Economy

In 1940, sixty-five different varieties of minerals, grouped as oil and gas, metals, structural materials, industrial materials, and salines, were mined throughout California. Their locations covered:

1. Petroleum and gas came from within and adjacent to the agricultural valleys, especially concentrated in the southwestern part of the State.
2. Metals, which include gold, quicksilver, tungsten, silver, and copper, with small amounts of lead, chromite, zinc, and antimony, were found almost entirely in the Sierra-Nevada, Coast, and Desert Ranges and Klamath Mountains. The majority of gold mines are located in the central portion of the Sierra-Nevada Mountains.
3. Structural minerals, which include cement, stone, brick and tile, lime, granite, slate, marble, and sandstone, originated largely from areas close to the cities.
4. Industrial materials, which include barytes, bentonite, pottery clay, diatomite, dolomite, gypsum, limestone, mineral water, pumice, pyrites, silica, and talc, were found in all sections of the State.
5. Salines, which include borax, common salt, soda, potash, and other alkaline salts, came from the dry lakes of the desert and the waters of the Pacific Ocean.

The extraction of minerals within the National Forests has been confined chiefly to metals and a small amount of industrial minerals. At present, many of these industrial minerals deposits are too remote to compete with discoveries closer to industrial centers.

The mineral production in 1940 was valued slightly under \$343,000,000, of which \$288,000,000 were in petroleum and gas products and \$60,000,000 in metals, principally gold. During the same period, approximately 45,700 persons were engaged in mining, with slightly over 50% employed in petroleum and gas production. In addition, a somewhat larger number of persons are supported by industries and occupations set up to service the miners and producers of ore, and a far greater number are directly dependent upon this supply of raw material to continue their work in manufacturing, processing, transporting, and marketing the final product.

Major Problems and Directive for Remedial Measures

One of the principal handicaps in management of forest lands has been the looseness of wording and the interpretation of the 1872 mining act. At that time, mining was the major industry, while activities in other fields of endeavor were considered highly speculative. The law, conceived primarily for promotion and expansion of mineral development in the West, allowed the patenting of public land for mining purposes, if indication of mineral values existed, regardless of the highest or most advantageous use in the public interest. Special provision was made for the survey and disposal of land for this purpose in advance of the regular system of rectangular surveys. Individual claims embraced 20 acres, and the applicant had the privilege of patent on completion of \$500.00 in labor or expense for the benefit of each claim and the payment of \$5.00 per acre for lode claims and \$2.50 per acre for placer claim. The cost of patenting mineral lands was 2 to 4 times the prevailing sale price for all other lands, which naturally reduced the tendency towards fraudulent mineral locations.

Today conditions are different. Instead of a price of mineral land being greatly in excess of the value for any other purpose, it is now frequently only a fraction of the conservative market value for purposes in no way related to mining. Virgin stands of commercial timber often represent a value of \$50.00 to \$500.00 per acre, while desirable sites for summer homes or resorts around mountain lakes and streams often sell for \$1,000.00 or more per acre.

This law of 1872 has excellently served the purpose for which it was intended, but now invites the acquisition of lands of no value for mineral purposes which have been reserved for public purposes and made accessible at public expense.

The greatest abuse now occurring in California is through the use of placer locations. Administrative problems caused by this form of mining location could be greatly reduced on National Forest lands through the enactment of legislation to substitute special use permit in lieu of further location and patent. It is generally conceded that surface placer mining as a commercial activity is a thing of the past, except in the limited areas where large deposits of gravel are susceptible to mechanized equipment. Under the permit system, the dredging of high-valued agricultural lands would require the leveling of the rock and gravel piles, and under some circumstances, replacing the top soil. Potential damage to downstream values would also be considered in determining the extent of reclamation required.

There is also a need to tighten up the requirements for holding mining claims to overcome the pretenses at "assessment work" which at present is not sincerely complied with on more than 5% of the local lode locations.

FOREST RECREATION

Mountain Recreation - A Forest Activity

The forest lands in California have been used for recreation for many years. As early as 1864, the people of this State created a state park to preserve and enjoy the beauty of the scenic wonders, now a part of Yosemite National Park. The type of use, within the National Parks, National Monuments, and some of the State Parks, which have been established to preserve unique landscape, vegetation, or geology, is restricted, however, so as to protect the values responsible for their creation.

The concept of recreation as one of a combination of uses on forest lands was not given any recognition until relatively recent years, even though there had been a continual use of public lands for this purpose without facilities or attention to the needs. Areas adapted to this form of use are found intermingled with timber, range, and watershed values, so that any plan of development must give ample consideration to all resources. Recreation does not, except in certain restricted areas, exclude other uses or prevent the correlation with other phases of forest management.

Lack of foresight has been the fundamental cause for the present dilemma. The delay in any positive action permitted recreation to become firmly established in advance of any plans to meet the needs on either public or private lands. The efforts of all agencies, so far, have been concentrated upon an unsuccessful attempt to catch up with the demand, with little or no opportunity for advance planning.

Development of Mountain Recreational Habits in California

The early inhabitants of California found the hot interior valleys uncomfortable during the summer months, and sought the higher elevations to escape the heat. There was born an annual movement from the valleys to the mountains in early summer and back again in the fall, for most of those who could afford the time and money for this migration. Overnight hiking trips became exceedingly popular in Southern California. The lower slopes of surrounding foothills attracted the sportsmen with excellent hunting and fishing, which could be enjoyed at the cost of only a little travel time.

Much of the love of the outdoors and the wide open spaces which inspired the early pioneers has been passed on to the young generations, who still go to the mountains, regardless of the location of their homes. The relative newcomer has also learned to appreciate and enjoy the pleasure from mountain recreation.

Population and Demand

Forest recreation is one product from forest lands that serves people directly in contrast to other resources which require various degrees of processing. For this reason, fluctuations in population are reflected directly and almost immediately in the demands for recreational outlets and facilities. A tremendous demand has been developed for recreational opportunities, which will continue to grow as working conditions improve and the increase in population continues to follow the anticipated trend upward.

Available Recreational Opportunities

Outdoor recreation can be obtained in various ways and in various places, as (1) the beaches along the coast, (2) the county parks, of which Los Angeles County has a number, chiefly confined to picnic opportunities; (3) the State Parks, which are scattered generally throughout the State at the lower elevations; (4) the National Parks and National Monuments; and (5) the National Forests.

The State Parks, the National Parks and Monuments, and the National Forests comprise practically the entire areas of publicly owned wild lands in the mountainous parts of California. Among them they offer the chief outlets for anyone who wishes to hunt, fish, enjoy the scenic beauty, or escape the valley heat. These areas also receive heavy snowfall, and offer excellent opportunities for winter sports.

The National Forests have come to receive a tremendous load of recreational use, because of their extensive area and geographical distribution. Simple types of recreation are provided which are compatible with the forest environment. Many accommodations frequently found in city parks are incongruous in a forest setting, and are therefore discouraged.

Pattern of Recreational Use - Past, Present and Probable Future

Through the years certain significant changes have occurred in recreational use of the mountains. In the early days hunting, fishing, and hiking trips constituted the bulk of the use. Then came a period when summer home sites were in great demand. Coincident with that trend, mountain resorts enjoyed a surge in public interest. This latter type of use flowered through the late 1920's, but the depression years brought about a move toward the less expensive forms of recreation. During the 1930's, camping increased considerably, while the resort business declined. In recent years, however, mountain resorts have enjoyed renewed popularity. It would appear, in the light of past experience, that the pattern of summer recreation is fairly well established, except that an increase may be expected in the use of wilderness types of country.

The use of the mountains and forests has been distributed generally throughout the State, with heaviest use falling upon the readily accessible sections. (In 1941, the latest normal year for which complete figures are available, 4,689,346 visits were made to the National Forests, aggregating 11,577,618 man-days of use. This figure excluded sightseers, through traffic, and similar visits of a transient nature.

On the basis of a study conducted in 1937, it was learned that approximately 90% of the National Forest visitors were from California, 3% from the other ten western States, 2% from the Central States, and 1% from the Eastern States. The remaining 1% came from foreign countries or were unclassified. No distribution figures are available for the additional millions who visited the National Parks, State Parks, and the developments on private lands during the same year.

The following recreational facilities were available within the National Forests in 1941:

10,481 camp or picnic units
61 winter sports areas
133 organization camps
158 hotels or resorts
6,864 summer homes



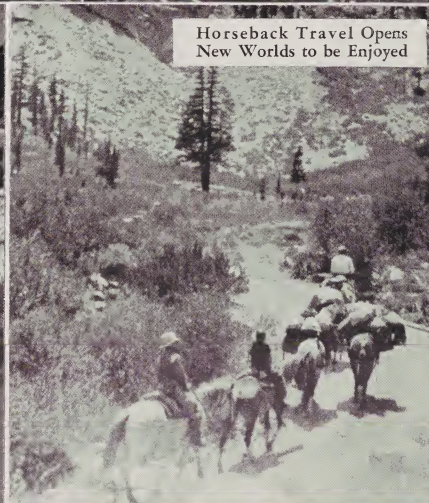
California's Mountains,
Lakes and Forests Offer
Boundless Opportunities for
Outdoor Recreation



Recreation Travel Demands
Good Highways



Fishing is a Favorite Sport
of Californians



Horseback Travel Opens
New Worlds to be Enjoyed



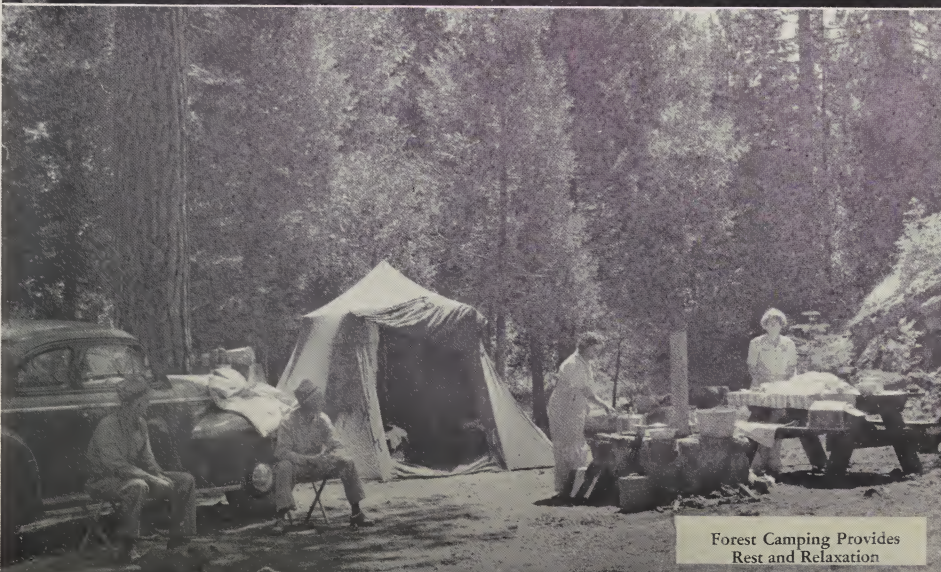
Winter Recreation Requires
Snow Removal from Roads
and Parking Areas



Swimming in Mountain Lakes Ap-
peals to Old and Young Alike



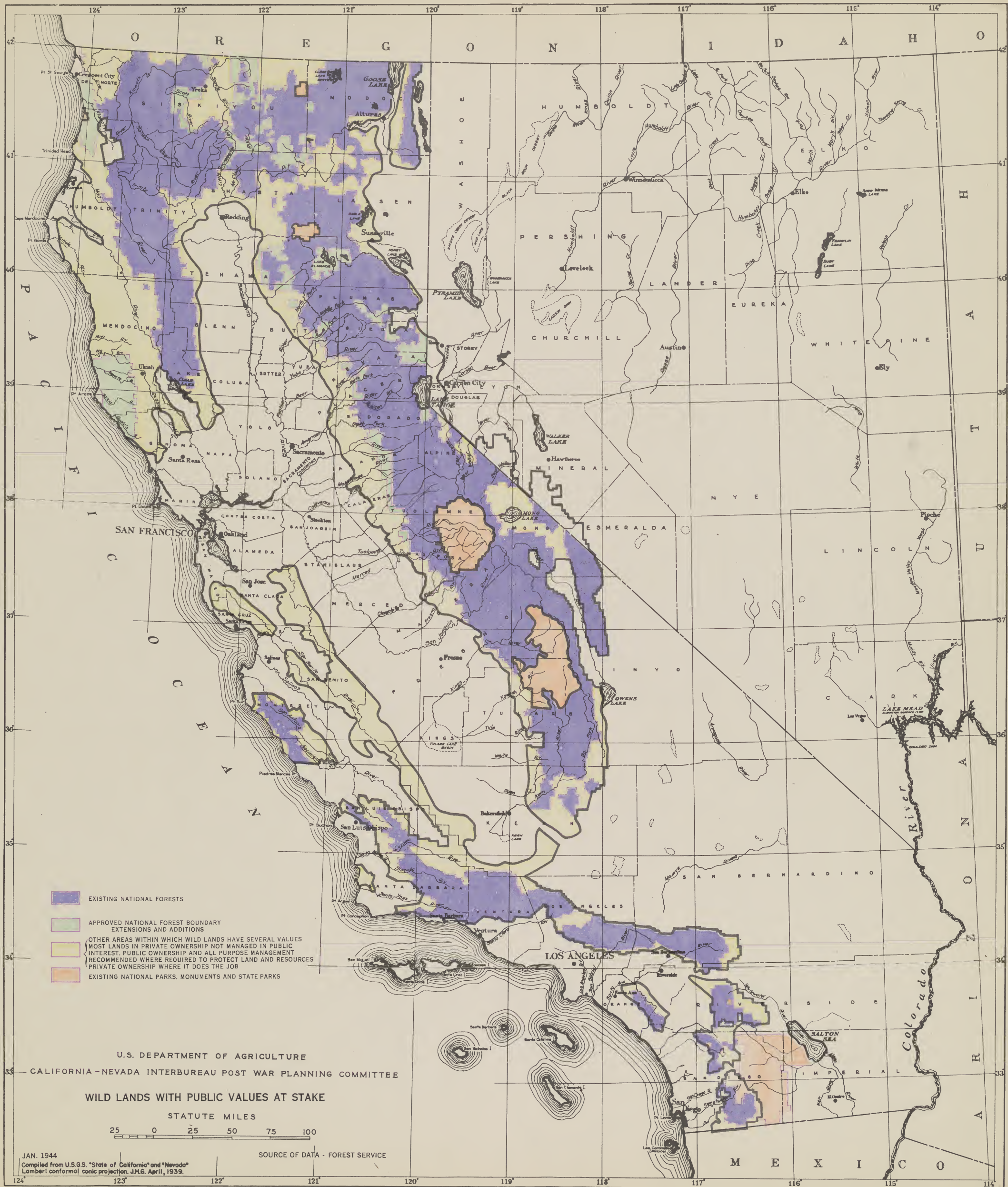
Skiing Has Become a Major
Recreation Activity



Forest Camping Provides
Rest and Relaxation



Congestion Can Be Avoided
Only Through Sound Plan-
ning, Adequate Funds and
Able Administration



Due to the inability to keep pace with the accelerated recreational demand, many of the existing developments, particularly in campgrounds, are obsolete and badly in need of replacement. On the whole, existing facilities are entirely inadequate to meet the normal needs.

As the population increases and the pattern changes in California from rural to urban, the opportunities for outdoor mountain recreation near the home decrease, especially those suitable for children. Organized groups are becoming more and more important as a means of overcoming this deficiency. A study conducted by the Pacific Camping Association in 1938 and 1939 indicated that 443 organization camps were needed in California to provide camping experience for youths between the ages of 10 and 17. At that time, only 140 such camps were in existence. The increase in population continues to aggravate the situation.

The greatest change in recreation has come about in the winter use of the mountains. In 1941 figures show 612,757 winter sports visits; a tremendous use in view of the fact that winter recreation had become popular only during the preceding five or six years.

It may safely be predicted that the post-war period will bring a continued up-curve in winter sports with a probable change in type of use. The young men of the mountain regiments, who have learned some of the joys of forest and mountain travel in the winter, will no longer be satisfied with the packed slopes and congestion of the ski centers, and will want to travel the trails, as the wilderness lovers do in the summer. And they will take their friends with them. The 125 miles of ski trails now posted will need to be increased greatly, and shelters will have to be provided as a protection measure. With all this, there must be further development of ski centers, playfields, and other facilities for the beginners.

Major Problems

How to meet the needs. Continued increasing pressure has come from the centers of population in Southern California and around the San Francisco Bay Area for inexpensive mountain recreation. Solution lies not only in providing necessary facilities to supply existing demands but also in conducting advanced planning on rather broad scale for an orderly expansion and development correlated with other uses of forest lands.

Problems on private lands. Early patents covering some of the choicest recreational areas, such as around Lake Tahoe or along the fishing waters of the McCloud River, have excluded or restricted public use. Forms of recreation on these lands are naturally planned to satisfy the particular desires of the owner.

It should be clearly understood that private lands can make a worthwhile contribution to mountain recreation. Resorts, ski centers, and similar commercial enterprises, along with uses of an exclusive or semi-exclusive nature, can well be directed into this channel to leave public lands available for campgrounds, picnic areas, and other similar types of inexpensive and less restrictive use. The extent of contributions is limited, however, by the lack of control on their fees, type of construction, and management.

Problems on public lands. The fundamental recreation problem on public lands, particularly in the National Forests, deals with the correlation of this activity with potential uses of other forest resources. Many of the recreational sites are terribly over-crowded during the summer season, while others are unattractive and only partially usable, due to obsolete facilities. An inventory of the recreational opportunities for winter as well as summer use, followed by an evaluation of land uses, should precede the preparation of any plans for expansion. Much of the basic data has already been collected, but further study and analysis of land uses is necessary. Once an over-all plan of management is derived for a watershed or some such area, detail plans for the use of an integral part such as a single campground would follow. Where public lands are not adequate to meet the public need, available private lands should be acquired.

A primary objective in forest land management is to maintain constant vigilance for the protection of recreational features and scenic values, especially along routes of public travel. The exploitation of timber adjoining highways; overgrazing of mountain meadow; excess concentration of recreational use, tend to destroy some of the particular type of beauty peculiar to mountain areas.

Contributions with Present Ownership Pattern

The vast majority of forest lands are capable of performing a useful, and, in most cases, an essential function in the State economy. To do this, however, they must be managed so as to at least maintain and possibly increase their natural productiveness on the basis of coordinated land use. Private ownership, with some exceptions, has neglected not only to provide such management, but also to protect the public interests inherent in the lands. This failure has been primarily due to economic pressure for rapid liquidation or lack of interest in permanent land management. Other influences of lesser importance are lack of knowledge on good practices and general character of the land.

Private Interests in Forest Lands

The principal incentive for private capital to invest in forest lands comes from the desire to control and use particular resources for profit or other personal gains. The general location and character of the land naturally restricts the opportunities for small subdivisions without the assistance of industrial or other developments as a means of support. On the other hand, the control of land on which a spring or waterhole is located can greatly influence the surrounding grazing use within a radius of several miles. The resort built on a few acres of private land can capitalize on scenic beauty and natural attractions for miles around not covered in their investment. There are, of course, cases where lands are held in private ownership to satisfy a possessive instinct. When the objective of ownership can no longer be attained, even at the sacrifice of public benefits, the land often reverts to county or state government in lieu of taxes.

Consequences of Private Ownership

Many of the results of private ownership have been covered in some detail in the discussion of the various forest resources. Some repetition, however, seems highly desirable in summarizing present conditions for clear evaluation.

The bulk of the virgin timber stands were patented prior to 1900 with the expectancy of attractive profits within a reasonable period of time. Some tracts could not be economically utilized for many years, and some are still not yet marketable. In these cases, there has been an accrual of taxes and carrying charges until the investment has approached and often exceeded the per acre return from liquidation. Some of the larger holdings were bonded at optimistic values and the proceeds were used to buy additional timber. When utilization was postponed, these bonds were defaulted and the bondholders often had to assume ownership. Many owners, in salvaging their investment, built mills and other installations far in excess of capacity needed for an orderly liquidation of the timber, thus adding to their financial burden.

The natural tendency under such circumstances has been to strive to obtain the greatest immediate return regardless of future productivity from the land. Where this policy is in force it has necessitated complete exploitation and practical denudation of standing timber to collect all potential material that can be utilized. Aside from the economic problems, private ownership has not only shown a persistent disregard for public interests inherent in forest lands, but also has expressed an unwillingness to assume the responsibilities of long term forest management. Convincing testimony can be exhibited with millions of acres of denuded lands which will not affirmatively contribute to local economy for a century or more, abandoned towns and sawmill operations, eroded and damaged watersheds.

Small homesteads were economic in the mountains during the early period of development in the State, when the population was widely scattered and means of transportation were slow and costly. The shift in population to the cities and the areas of intensive agriculture in the valleys, along with a vastly improved transportation system, no longer provides these owners with a market where they can readily dispose of their products at a profit. Persistence to remain if only to eke out a livelihood eventually leads to abusive practices in the use of the land resources.

In Southern California, where mountain recreation is a major activity, suitable sites for this form of use are extremely limited. Some of the patented areas have consequently been developed as resorts in a desirable or at least an acceptable manner. Many more, however, are either the location of an individual's cabin or the scene of an ill-advised attempt to establish a farm on lands obviously not suited for such use. These areas are frequently located in the midst of highly inflammable cover with high watershed values. The buildings are often crudely constructed and seldom fireproofed. The occupants, more often than not, are careless of fire. With the risks as great for the values at stake, it is imperative that strict control be established and maintained on the development and use of the land. Such control is not obtainable over private property.

Methods to Stabilize Private Ownership

There are now in force or have been proposed, numerous methods of public assistance to provide partial relief to the problems involved with private ownership. Publicly financed research has made available a large body of information of use and value to land owners. Federal aid to the states for fire control on timber and watershed land has been in effect for many years, as has a federally financed campaign against white pine blister rust and, to a lesser extent, against pine beetle infestations. Proposed remedies include public credit at low rates to forest industries and timber holders, increased public assistance in fire and disease control, revision of methods of property taxation as they apply to forest lands, and varying forms of public regulation.

None of the proposals will repair the effects of past mismanagement on those lands which have heretofore been denuded, burned, overgrazed, and eroded, requiring extensive rehabilitation to restore their productiveness. They will not cure economic circumstances which led to overgrazing, misuse, and consequent deterioration of range and watershed areas. Some of the pressure for premature liquidation has already been overcome. Undoubtedly a system of forest credits and forest insurance will be a step forward towards a more orderly harvesting of timber resources, and will stimulate timber owners to practice intensive forest management. These remedies will not, however, solve the problems dealing with over-investment in timber, excess milling and manufacturing capacity, heavy tax burden placed on timber land in the mountain counties, and illogical patterns of many ownerships which make long-term management impracticable. Singly and together, they should accomplish a great deal in making long term private ownership and management of the better lands more feasible but it is not to be expected that they can perpetuate the existing structure.



First-Class Equipment
Speeds Fire Control



Constant Vigilance Detects
Fires Quickly



Modern Firefinders and
Alert Lookouts Are Essential



Construction of Fire Line to
Control Forest Fire



Portable Radio Speeds
Communication



Back Pack Pump Is a Useful
Fire Fighting Tool



Bulldozers Save Much Hand-
work in Fire Fighting



Roadside Markers Inform
Public of Forest Boundaries



Forest Supervisor
Headquarters



Good Bridges Are Needed in
Forest Transportation



Forest Guard Headquarters

Kind of Mountain Lands for which Public Ownership is the Effective Method

Full protection of the public interest in forest lands will require substantial extension of public ownership as a complement to increased assistance to private owners. Lands should be publicly owned which will require investment of public funds to arrest destructive processes and to restore productive capacity. Such an arrangement would not only permit the benefits of the investments to accrue to the public whose funds have been used but would also assure adequate protection and management for the rehabilitated areas. Lands for which private ownership cannot or will not guarantee a form of management that will protect and preserve the essential public values should also be acquired.

The following program of public acquisition is proposed:

- (1) All lands whose value is predominately for watershed purposes, except those which are held by water companies or other public service enterprises and which are being adequately administered and protected.
- (2) All lands of timber producing potentialities which need restoration and rehabilitation with public funds. All reproducing timber lands or uncut timber areas for which conservative management of timber and subordinate resources and protection of watershed values is not reasonably assured under private ownership. Tracts of timber lands, the resources of which must be managed in a definite and specified manner so as to sustain local industries and communities where such management cannot be achieved under cooperative agreements or is not assured under private ownership.
- (3) Key tracts or areas which are needed for public service or in which public interest transcends private use.
- (4) All those lands of range and watershed character which need extensive rehabilitation with public funds or on which radical changes in use are necessary to prevent further damage. In addition, those on which conservative management for protection and perpetuation of the several resources is not reasonably assured. Key areas, such as mountain meadows and water-bearing tracts, which are needed to permit full control of public ranges.

FIRE IN THE MANAGEMENT OF FOREST LANDS

Directive in Fire Protection

All forest resources are susceptible in some degree to the destructive force of forest fires. The timber stands, young and old, the wildlife habitat, and the gems of scenic beauty face the risk of devastation from this cause which cannot be restored for many years or even many decades. The erosion of forest soil, which comes with the loss of tree or plant growth as protective ground cover, muddies streams and fills reservoirs. This deteriorating result requires expenditures in millions of dollars to safeguard existing investments aside from the centuries it will take nature to replace the surface soil and fertility to again grow forest vegetation.

In brief, the intensive management of forest resources is not a feasible undertaking without adequate fire protection. In this State the problem is accentuated with the extreme fire hazards caused by climatic conditions and the almost year-round use of the forests by many hundreds of thousands of people. The level of protection must consider the forest values at stake and, in any event, should be provided at the lowest possible cost that will permit the attainment of plans for management.

Fire Behavior

There are two conditions that make the control of fires extremely difficult, especially in those cases where fires are not suppressed on initial attack. These are (1) fast rate of spread; (2) extensive areas of dense vegetation which interfere with the construction of control lines.

As a general statement, more rapid spread may be expected with the vegetative types and conditions found in the low, dry sites in comparison with those of the higher, cooler elevations. The mountainous brush-covered lands of Southern California require an initial attack within 15 minutes of discovery, to assure control as small fires. Along the western slopes of the Sierra-Nevada Mountains, 30 minute attack is necessary for the area from the lower limits of forest land, consisting of grass, brush, and timber types, up to and including the general range of ponderosa pine. The assumption in both cases is based upon adequate manpower attacking the fire.

Many of the large fires with combinations of bad fire conditions prevailing--wind, inflammable cover, low humidity, etc.--make a big run within the first 24 hours. An excellent illustration to show rapidity of spread is the 1932 Matilija fire on Los Padres National Forest, where an initial effort at control had failed. The location of fires and density of cover greatly influence their minimum size.

Particularly dangerous is the threat from large fires in one drainage or watershed to the values located in adjacent areas. When fires are not controlled promptly, they may scatter far and wide in such a pattern that each one becomes a separate problem. There is always the danger that a conflagration will occur to affect the burning conditions over a large area which will preclude any possibility of prompt control.

Recent Trend in Development

Major attention in recent years has been focused on the mechanics of fire-fighting--ways and means of transporting men and equipment, location and size of crews for initial attack, prompt detection, improvements in communication, etc.

One of the more important studies has been the determination of time limits within which adequate forces must reach fires so as to hold the burned acreage to acceptable limits. The result of this work has been the basis for plans to fit the location of fire suppression crews to the zones of fire occurrence so that coverage could be maintained within the prescribed time limit for specific types of vegetative cover. This study has also been instrumental in directing future plans for strengthening the present fire organization.

Rapid strides have been made in the development and use of fire equipment. For example, extensive investments have been made for the purchase of tankers and trailbuilders, in line with studies showing where they can be used to advantage. The modern crew now attacks a large number of its fires with the help of water from a tank truck followed as rapidly as possible with the slower moving trail-builder. The latter is particularly useful in constructing control lines in heavy brush, where it has been a slow progress by hand.

Airplanes have also come into extensive use for reconnaissance purposes on going fires and for delivery of supplies to isolated camps where the problem is difficult.

Over the years, studies have been made as to the causes of fires with preventive measures set up to meet as many of them as possible. An outgrowth of this work has been the issuance of free campfire permits to control the use of fire in the National Forests of this State and to direct their location to specially prepared or fireproofed areas.

Other measures which have had their effect are the restriction of smoking to posted areas or places of habitation, and an active law enforcement program. Results of fire prevention effort are clearly shown in the downward trend in man-caused fires in proportion to use during the 5-year period preceding the war.

Steps to Strengthen Fire Control Program

The general needs are universally known and plans well advanced for necessary protection roads, trails, telephone lines, housing, and similar improvements to be added to the present system as funds are made available.

Not more than a start has been made so far towards the reduction of fire hazards that comes with removal of snags, fireproofing roads, and clean-up of accumulated slash and down trees. Valuable stands of merchantable timber should be interspersed with adequate fire lanes and firebreaks to bring the risks more in line with the values at stake. Work of this sort is sorely needed to get a better balance in fire control which would result in fewer major suppression jobs and major losses.

Additional information is needed in the following phases of the program:

1. Most effective type of organization and strategy on large fires.
2. Suitability and possible improvement of available tools and equipment.
3. Use of chemicals in fire suppression from the air and on the ground.
4. Use of airplanes, especially helicopters, on initial attack.
5. Improve fire prevention technique.
6. More dependable fire weather forecasting system.
7. More accurate evaluation of fire damage.

Expected Effectiveness When Plans are in Full Operation

When all of the planned facilities, man power, and equipment are available, California should be able to keep its annual losses from fire down to an acceptable point with a noticeable reduction in suppression costs. The protective force will be suitably housed, which will help to increase the attractiveness of the jobs and so claim the interest of a higher type of short-term employee. The fireproofing of the more dangerous areas will make possible their use by the public without excessive danger to the resources.

A continued prevention program should be effective in reducing the number of fires caused by human carelessness to a low point. Restrictive use in the highest risk areas will help to control fire occurrence if they are effectively enforced. Hunting seasons can be set, as far as wildlife management permits, so that the use of the National Forests for this purpose will be at seasons when there is the least danger of fires.

The full development of camp grounds and fag stations to meet peak needs will help to permit full utilization of the recreational resource with a minimum of danger. Enforcement of high standards of building codes will assist in reducing the number of fires that come from burning buildings.



Experiments Determine the Best Planting Stock



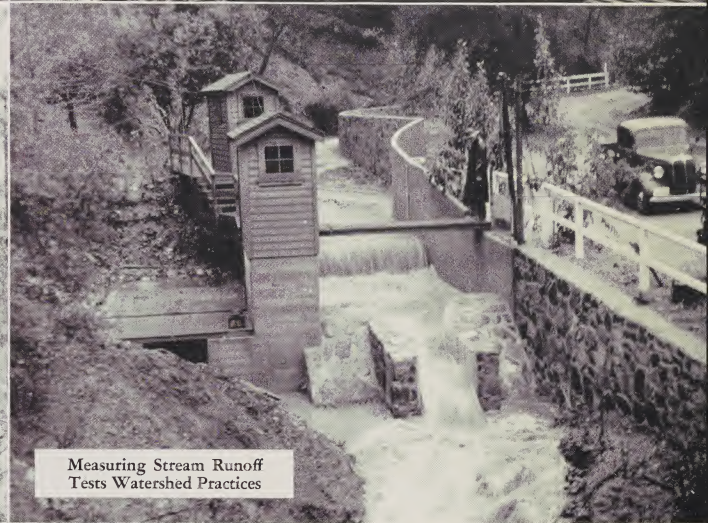
Studies on Logged-Off Lands Aid Reforestation



Sawmill Studies Improve Lumbering Practices



Study Plots to Evaluate Cutting Practices



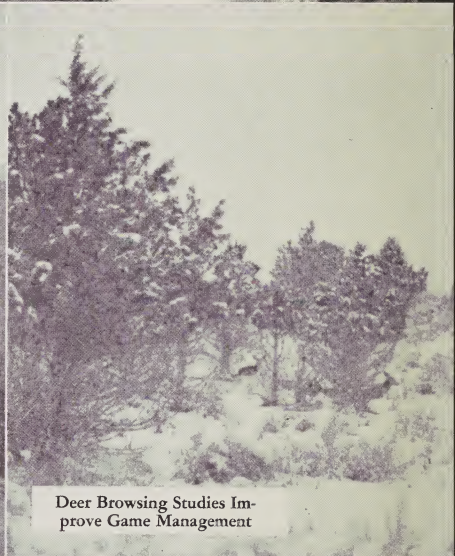
Measuring Stream Runoff Tests Watershed Practices



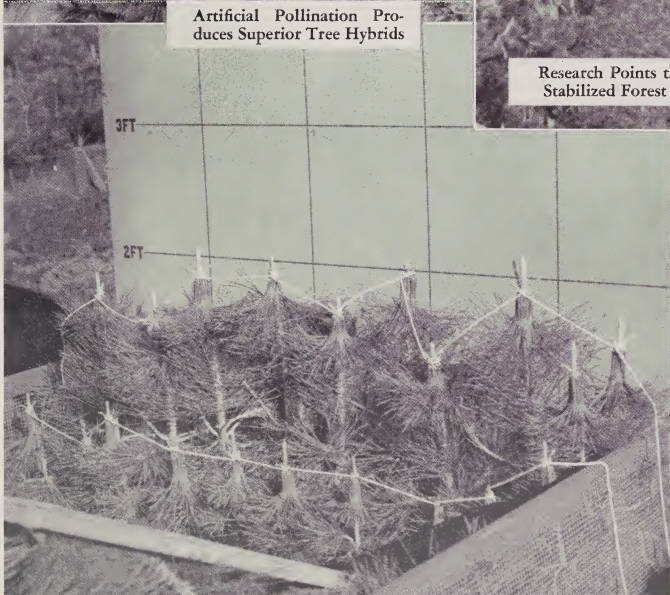
Artificial Pollination Produces Superior Tree Hybrids



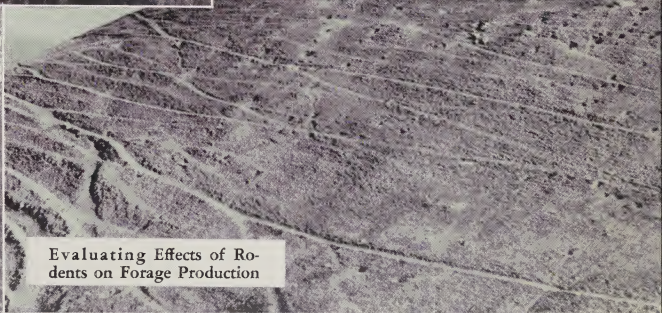
Research Points the Way to Stabilized Forest Industries



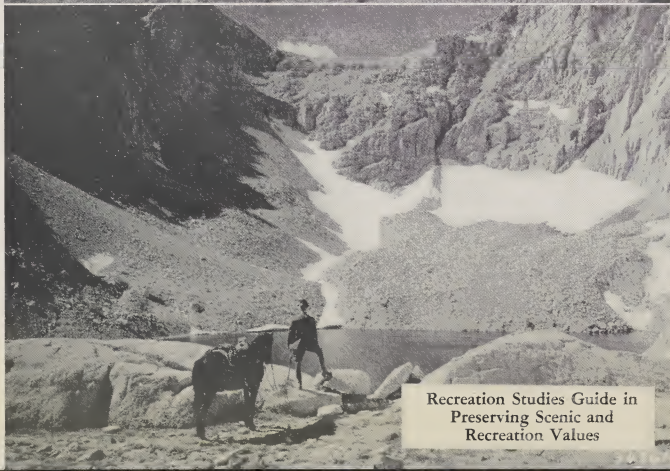
Deer Browsing Studies Improve Game Management



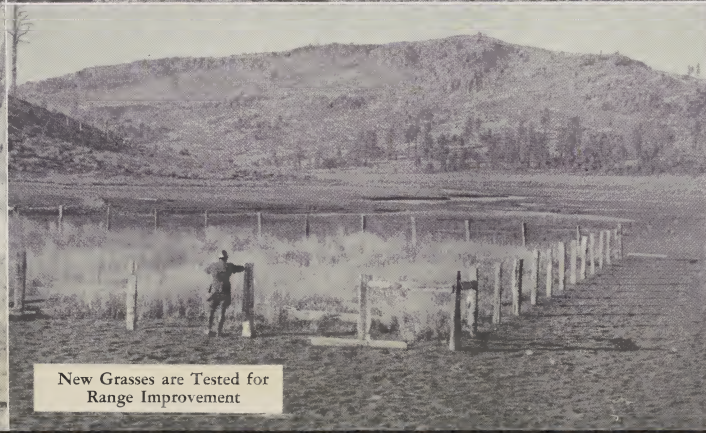
Experiments with Efficient Range Practices Show Increased Weight



Evaluating Effects of Rodents on Forage Production



Recreation Studies Guide in Preserving Scenic and Recreation Values



New Grasses are Tested for Range Improvement



Vegetation Surveys Facilitate Land Management

RESEARCH PROGRAM FOR CALIFORNIA FOREST AND RANGE LANDS

The Role of Research

The people of California have grown to appreciate the value of forest lands in both the rural and industrial economy of the State. In contrast, research has lagged behind the needs of forest management primarily because of limited manpower and facilities.

Early forestry investigations were concerned with the introduction of new or foreign species, planting of shelterbelts, direct seeding of deforested areas, and forest-cutting experiments. In 1910 detailed studies of forest tree diseases were begun, followed shortly by investigations in the control of injurious insects. Later came the establishment of experimental forests devoted primarily to studies in forest tree culture, the initiation of work in utilization of forest products, grazing studies on forest ranges, studies of the role of water both as an enemy and as a benefactor of forests, and research in other fields, including tree breeding, fire protection, and economics. Research on some forest land problems is now pursued by several agencies of the Department of Agriculture, the University of California, the State Division of Forestry, industrial trade associations, private industrial organizations, and a few far-sighted counties and municipalities.

There has been built up, through the combined results of research and trial-and-error experience, a body of facts sufficient to justify the program of management recommended in this post-war plan for forest and range lands. There are, however, three great needs: (1) many problems have not received the benefit of research analysis, (2) no satisfactory criteria are at hand to ascertain the ultimate intensity of management that may be attained or justified, (3) techniques and methods can be further refined into more effective resource-management tools.

Under war-time pressures research on forest and range lands has been curtailed to a degree far out of line with the relative position that forest and range resources now hold and will continue to hold in the post-war economy of California. The fields of research wherein the greatest need lies, and the scope of recommended investigations that will fully implement post-war stewardship of mountain lands are discussed below.

Fields of Research

A. Managing the Timber Crop

Successful growing of timber is a complex biological undertaking. Among the problems that silvicultural research must help solve are: (1) modification of cutting practices to insure natural regeneration of the more valuable pines, especially sugar pine; (2) methods of reducing mortality in trees left after logging, especially in stands of mixed species; (3) more efficient thinning, release, and pruning methods that will permit the working of areas now considered submarginal; (4) methods of seeding, planting, and site preparation effective in reforesting land of intermediate quality with premium species not now successfully handled; (5) life histories of inferior species and shrubs to discover weak points through which undesired invasion of forest land may be forestalled; and (6) calculation of volume and yield tables for forest trees and other research in the methodology of measuring or inventorying forest resources.

Forest engineers must develop new operating methods and equipment. These might include (1) logging machinery less injurious to reproduction and better adapted to profitable handling of lighter stands with less valuable trees, and (2) cheaper, more effective brush-clearing methods and equipment.

In virgin old-growth forests (7.8 million acres), silvicultural research must be focused primarily on extensive practical trials of cutting methods that earlier small-scale studies indicate to be technically sound. This research is aimed at reducing excessive mortality among trees left after cutting, increasing the rate and quality of growth in the residual stand, and facilitating natural regeneration of the best trees by developing conditions favorable to seedling growth. These trials should be conducted mainly on experimental forests located in the more important forest types in California and should make use of modern logging equipment and methods and experimental sawmills. With these experiments should also be studied phases of forest utilization and experimental methods of management.

In the cut-over forest areas that are now restocking (5.3 million acres), research can develop reliable and economical thinning, pruning, and other cultural methods to improve the growth rate and quality of the new stands. In the entire State there is a deficiency of intermediate-age trees. When all virgin forests have been cut over there will be a timber shortage until the second growth now established is ready for harvesting. Cultural methods speeding up development of this second growth will reduce the period of timber scarcity.

In the waste areas (6.1 million acres) that are potential commercial forest land, research should develop effective techniques of direct seeding and nursery culture and transplanting of such species as sugar pine, incense cedar, the firs, and cork oak. Knowledge in this field is now limited mainly to ponderosa and Jeffrey pines. Also, insufficient facts are at hand regarding forest-soil characteristics and other factors of environment for effective selection of potentially productive planting areas.

B. Breeding Forest Trees

Silviculture seeks the best from existing trees, and genetics seeks to improve the valuable inherent characteristics of common forest trees evolved by chance.

A comprehensive program of experimental breeding of pines now in progress is aimed directly at increasing growth rates and developing strains exceptionally resistant to disease, insects, fire, drought, and frost. If crossbred trees can be developed to meet the objectives, less time will be needed to produce merchantable timber, young stands will be susceptible to ground fires for a shorter period, the cost of present-day protection measures will be reduced, and, because of increased hardness of the new trees, forests may be grown where none occur now. Research in forest-tree physiology, cytology, taxonomy, and dendrology is essential to the development of a tree-breeding program.

Post-war reforestation and research in genetics are complementary. Hybrids may be tested in large-scale plantings on waste lands, and planting stock grown for the genetics program will be available for reforestation.

Quality of wood produced is as important as rate of growth and resistance to adverse environmental factors. Test hybrids and selected forms now growing in plantations have reached sufficient size to be tested for physical, chemical, and structural properties of wood in comparison with the parent species.

C. Utilizing the Timber Crop

The Forest Products Laboratory of the Forest Service at Madison has heretofore served the entire nation in laboratory studies of wood products. With increasing utilization of wood and consequent demands for experimentation on western woods, the work of the Forest Products Laboratory should be supplemented by research conducted in the West on specialized western problems. Evidence that the need has not been met by existing Government laboratories is the recent establishment of forest products laboratories by the University of Washington, Oregon State College, the Western Pine Association, and the Weyerhaeuser Timber Company, and the continuation of products research of many years' standing by the Pacific Lumber Company. The State of California is now considering the establishment of a laboratory in the Division of Forestry of the University of California. There is no question of the need for further research in western forest products, particularly on a pilot-plant basis. Uses should be developed for wood now wasted in logging, cultural, and saw-mill operations.

A post-war research program in wood utilization outside the laboratory should encompass two major lines of work:

1. Development of quality grading rules for logs and trees. As old-growth timber is cut over, margins between costs and returns will become narrower and increasing attention will have to be paid to the quality of logs and trees and the wood. Simple yet effective grading rules will help to show with greater accuracy what costs and methods of post-war logging will be most economical.

2. Development of more efficient utilization practices in the woods. Improved methods of logging, sawing, seasoning, treating, and fabrication may switch some sizes, grades, and species of trees from the submarginal to the supermarginal class and may also remove established trade prejudices against certain species. Hardwood resources of this State are practically unutilized despite the existence at Los Angeles of the third largest furniture manufacturing center in the country. The difficulties of processing alder, madrone, laurel, chinquapin, tan-oak, and other oaks have helped to prevent their acceptance by the hardwood trade, which, before the war, relied almost entirely on imports from the Philippines and South America and on temperate hardwoods from the East Coast.

D. Protecting Mountain Land

Forest protection research considers the study of control of adverse environmental factors, including fire, insects, disease, rodents, and concentrated human use.

1. From fire. Reasonable control of fire losses is essential to successful management of forest land in California. Administrative action in protection from fire requires specialized knowledge of (1) occurrence and behavior of fire, (2) activities, methods, and techniques most effective in economically preventing and controlling fire, and (3) beneficial and detrimental effects of fires on the land and the resource.

To meet the protection needs of an intensive forestry program effectively, the few high-priority problems proposed for attack are to (1) recognize and evaluate fire damage, (2) prevent the start of fires without serious curtailment of human use, (3) determine possible uses of fire as an aid to management, (4) organize and distribute manpower, equipment, and facilities to meet protection needs of individual management units, (5) develop plans of strategy for suppression of large fires, (6) best organize suppression forces on large fires, (7) make maximum use of fire-control equipment, services, and facilities.

2. From insects. To meet the needs of intensive management of California timber stands there should be studies of the pine seedling weevil, cone and seed-eating insects, insects in the nursery, the effect of cutting methods on losses from western and mountain pine beetles, damage to veneer logs from ambrosia beetles, and studies of factors contributing to insect damage in mixed conifer forests along the western Sierra Nevada.

Insects are frequently responsible for serious damage to the forage crop on forest and other range lands. Principal losses usually occur during epidemic insect infestations. Infestations of such insects as tent caterpillars and Mormon crickets may result in almost complete denudation of the forage cover over extensive areas. The research program should provide information on (1) factors that influence the susceptibility of insects to different control measures, and (2) best methods of carrying out control measures in the field.

3. From disease. With the changing emphasis in California on scientific production of timber there is more need for intensive study of diseases that tend to limit production. Tree diseases may be important in all phases of a tree's growth and utilization. Intensive research should be undertaken to provide urgently needed information on (1) endemic diseases affecting the growth and survival of forest trees, (2) epidemic diseases, such as white pine blister rust, (3) heart rots in mature timber, and (4) decay in wood products.

4. From rodents. Experience has shown the need for rodent control in the management of both timber and forest range areas. Some research has been carried out on factors affecting control, but many important aspects of the problem remain unsolved. An intensified research program should establish (1) proper ecological relationships between rodent populations and different forest-land uses, (2) characteristics of rodents that determine their susceptibility to control treatments, and (3) most effective methods of accomplishing field control.

E. Managing the Forage Crop

The following range research projects are recommended and apply equally to forest-covered and open range lands.

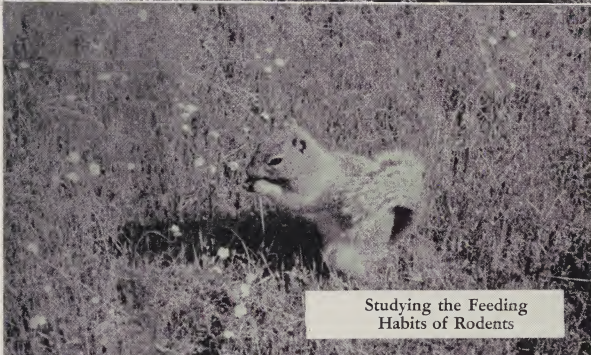
1. Forage-site value. A basis is needed for determining amount and quality of forage production and rate of range improvement under certain types of management. This includes appraising the properties and surface condition of range lands and the kinds of plants growing there.

2. Life history of individual range plants. A knowledge of trends in nutritive value, palatability, and digestibility of better forage species, singly or in combination, is necessary for best coordination of grazing to obtain maximum livestock production. Studies of growth, reproduction, chemical composition, grazing value, and management of good grazing species and noxious plants are needed.

3. Standards of grazing. Extreme undergrazing or overgrazing can now be recognized; but the line between overgrazing and undergrazing cannot be drawn with certainty. Further development of simple rules for judging the maximum degree of grazing that different ranges will stand without deterioration and loss of fertility is greatly needed.



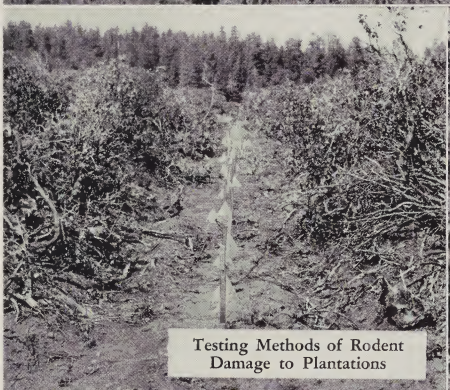
Testing Methods of
Erosion Control



Studying the Feeding
Habits of Rodents



Test Fires and Fire Weather
Studies Yield Basic Fire
Protection Facts



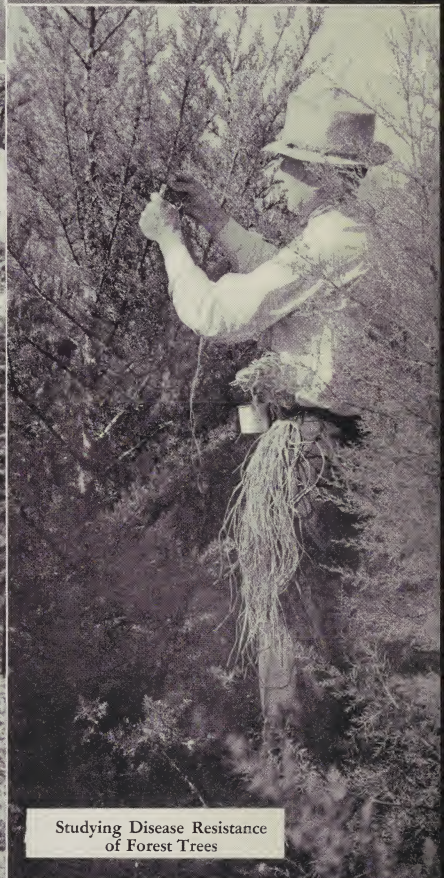
Testing Methods of Rodent
Damage to Plantations



Studying the Control of
Reproduction Weevil



Virgin Areas Provide a Lab-
oratory to Study Nature's
Way with Forestry Problems



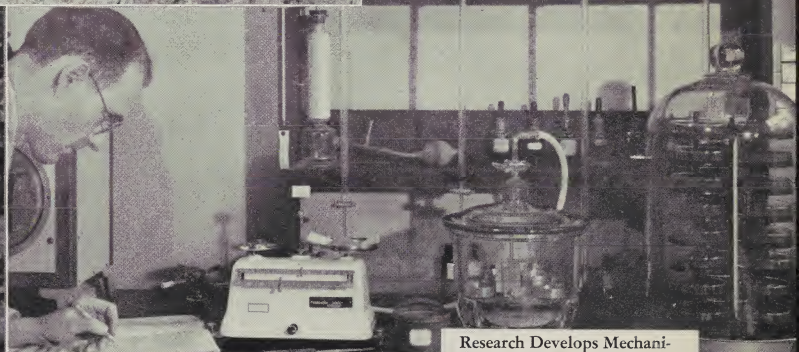
Studying Disease Resistance
of Forest Trees



Injecting Chemicals to Pre-
vent Insect Attack



Knowledge of Insects Important to Forest Protection



Research Develops Mechanical
and Chemical Methods
of Blister Rust Control



4. Grazing practices for different range types. Controlled pasture experiments are needed on different types of ranges to test (1) different seasons and intensities of grazing, and (2) different methods of livestock handling or animal husbandry that will yield maximum production.

5. Artificial revegetation. More efficient and positive methods of artificial revegetation applicable to California conditions have to be worked out to improve potentially valuable range lands. The selection of species adapted to specific sites is particularly important. The extent to which fertilizers can be used needs to be investigated.

6. Cultural practices. Certain brush and woodland types can be converted into better grazing lands by clearing. Experiments are needed to determine clearing methods best suited to different sites and plant species to safeguard range, soil, and watershed values during the clearing process. The range can be improved in many places also by changing the water level in the soil, impounding water on the ground surface, irrigating, and draining swampy areas. The effect of changes in moisture on the composition and growth of forage needs study.

7. Fluctuations in forage production and relation to weather. Information on the frequency and degree of fluctuation of forage yields would help ranchers in planning the amount of reserve feedstuffs needed for years of low forage production. Research in this field is important.

8. Economic problems of the range. Interrelationships of mountain, foothill, and valley ranges and cultivated lands must be known so that the most efficient means of livestock production can be determined. The relationship of grazing to other uses of the same land--timber production, watershed, game management--should be analyzed.

F. Managing Wildlife Resources

Wise management, including the proper establishment of hunting seasons, bag limits, and satisfactory game refuges, is dependent on factual information. Research on the following subjects is much needed: (1) life-history studies of game animals, predators, rodents, birds, and fish, stressing field behavior; (2) forage requirements of big-game animals; (3) diseases of wildlife as a factor governing populations, especially diseases transmissible to man; (4) restoration and management of the fur resource; (5) influence of rodents and other wildlife on growth and reproduction of trees, shrubs, and other plant species; (6) water management and control of stream pollution in the interest of fish propagation, particularly trout; (7) development for migratory waterfowl of breeding areas and special shooting grounds.

G. Forest Recreation Research

The widespread use of mountain lands for recreation is so recent that research in this field is almost entirely lacking, and certain emphatic needs have developed for facts that can be gathered efficiently only through research. These include:

1. Studies of deterioration of vegetative cover as caused by recreational use. It is necessary to know the maximum use that will not hinder recovery of vegetation during the off-season, cultural practices necessary to maintain adequate vegetation and to rehabilitate depleted areas, and types of vegetation most satisfactory for rapid covering of construction scars.

2. Psychological and social studies of recreation preferences and types of recreation most beneficial to vacationists.

3. Roadside, waterfront, camp, and trail analyses to determine the area and treatment necessary to preserve scenic values and prevent blowdowns when areas back of the scenic strips are logged, best methods of fireproofing scenic strips without destruction of their values, and possibilities of planting and selective cutting within roadside zones.

4. Studies of design of recreational facilities suitable for various forest environments.

H. Managing the Water Crop

The job of research in water management is to discover the principles of water behavior and the factors that influence it; then, in cooperation with action agencies, formulate methods of watershed management for the control and improvement of the water crop.

To accomplish this, research must (1) develop methods of appraising in quantitative terms the influence upon the water crop of different types and conditions of natural vegetation, (2) determine the effect of various types and intensities of use upon the future condition of a watershed and upon the quantity, rate, and quality of the water crop, and (3) develop and test direct remedial measures for the improvement of watershed conditions that adversely affect the water crop. Studies should include appraisals of the effects of lumbering, grazing, recreation, and fire. The remedial measures--which include such work as channel improvement by clearing, planting, and structures; hastening the revegetation of burned areas by cover-crop sowing and planting; special treatment of slides and other bare spots--are aimed both at strengthening weak spots peculiarly susceptible to deterioration and at providing emergency treatment of accidental setbacks in the watershed.

In view of the special acuteness of water problems in the southern part of the State--water shortage, floods, and accelerated erosion--the major research effort has been concentrated on one of the watersheds serving the Los Angeles County area. Post-war research will be carried on largely at this and other work centers established before the war in the more critical areas of central and southern California. Continuance of research activities listed below is essential to supply information needed in efficient water management:

1. Influence of natural vegetation on stream flow, involving interception, infiltration, small plot, well, and watershed studies of precipitation and run-off relations.

2. Water utilization by vegetation, involving lysimeter, soil moisture, and similar studies of the disposition of precipitation, especially by evaporation and transpiration.

3. Stabilization of soils, including (1) plot, stream-channel, and reservoir studies of soil stability and debris movement, and (2) studies of the propagation, growth, use, and effectiveness of vegetation for soil stabilization.

4. Watershed improvement, involving the installation and testing of upstream flood and erosion-control measures.

I. Appraising Economic Factors

Least attention has been given in research to the complex relations between mountain lands and the dependent economy. The history of forest land development, the importance of forest products in the present economy, and prospective demands during post-war industrial growth are compelling testimony to the need for economic research on forest lands. In addition to the economics of timber production there are those of watersheds, recreation, wildlife, and range management on forest lands.

A planned economics program should allow the undertaking of such short-term studies as analyses of county economies, land ownership, or other problems needing prompt if only partial solution.

A few foremost problems recommended for study in a realistic research program are:

1. Financial aspects of management on private and public forest lands. The fundamental purpose is to explore management of forest lands for profit in monetary terms on private lands; in both monetary and non-monetary terms on public lands. The study of cost of forest management, protection, and ways to relieve financial pressure towards liquidation not only would go far toward determining the allowable cost of forestry compatible with private ownership but would also indicate lands submarginal for private forest enterprise.

On publicly owned forest lands, the recapture of capital investments is still largely a matter of judgment. Much work needs to be done to evaluate in monetary terms the returns from public forestry which have heretofore been considered intangible benefits. Financial studies must consider not only direct monetary returns from timber and range products but also the worth of water, recreation, and wildlife.

Much of the cost-accounting data would be collected at established experimental forests where different types of management may be tested in conjunction with experimental sawmills.

2. Effect on dependent population of various intensities of forest management and industrial organization. The main objective is to ascertain to what extent population dependent upon forest land may be increased by (and thereby justify) capital improvements, cultural practices, forest protection and management, public ownership, and strategic placement of manufacturing facilities. Studies would include (1) the comparative population supportable under intensive and extensive management on both timber and watershed forests, (2) the productive efficiency of different sizes and kinds of manufacturing plants in terms of manpower requirements per unit output, and (3) desirable location of plant and remanufacturing processes in relation to raw-material supply, market demand, and dependent population.

3. Development of marketing structure for new, low-grade, and waste forest products. By research in establishing more effective channels of distribution, such as experimental cooperatives, and improved facilities for credit rating, markets can be expanded to absorb more wood fuel from logging slash and stand improvement, hardwoods for the furniture trade in Los Angeles, and other forest products. As a result, revenue will be increased, thus justifying more intensive cultural practices and capital-improvement measures on forest lands.

Facilities for Research

The success of the post-war research program will be determined primarily by the number and quality of scientists or leaders available. Leaders capable of directing research are few and their numbers cannot be increased at will by brief training. It is important, therefore, to employ this directive energy efficiently by providing adequate facilities--land and dwellings, labor and laboratories, test tubes and tractors. Industrial operations are not subject to rigid experimental control and therefore cannot be substituted for experimental forests and ranges and pilot plants.

A. The Foundation Sciences

Institutions conducting research in sciences basic to the management of forest and range land should be utilized to the utmost. California has several well-equipped universities and other establishments directed by able scientists in such fields as plant nutrition, soil technology, climatology, and animal sciences.

B. Forestry Institutions of Regional Scope

Institutions conducting forest and range research which have headquarters in the San Francisco Bay area are well situated to the main offices of the regional forest and park administrative agencies, forest and livestock industries and associations, universities and colleges, libraries, and allied interests.

Department of Agriculture representation in the Bay Region includes the Division of Forest Insects in Berkeley, conducting studies of forest and shade tree insect enemies, in cooperation with the University of California; the Division of Plant Disease Control, in Berkeley, conducting investigations in blister rust control; the Division of Forest Pathology, studying forest and shade tree diseases, in the Regional Office of the Forest Service in San Francisco; the California Forest and Range Experiment Station, carrying on general forest, watershed, and range research in cooperation with the University of California; and the Division of Irrigation of the Soil Conservation Service in Berkeley, in charge of cooperative snow surveys and water run-off forecasts.

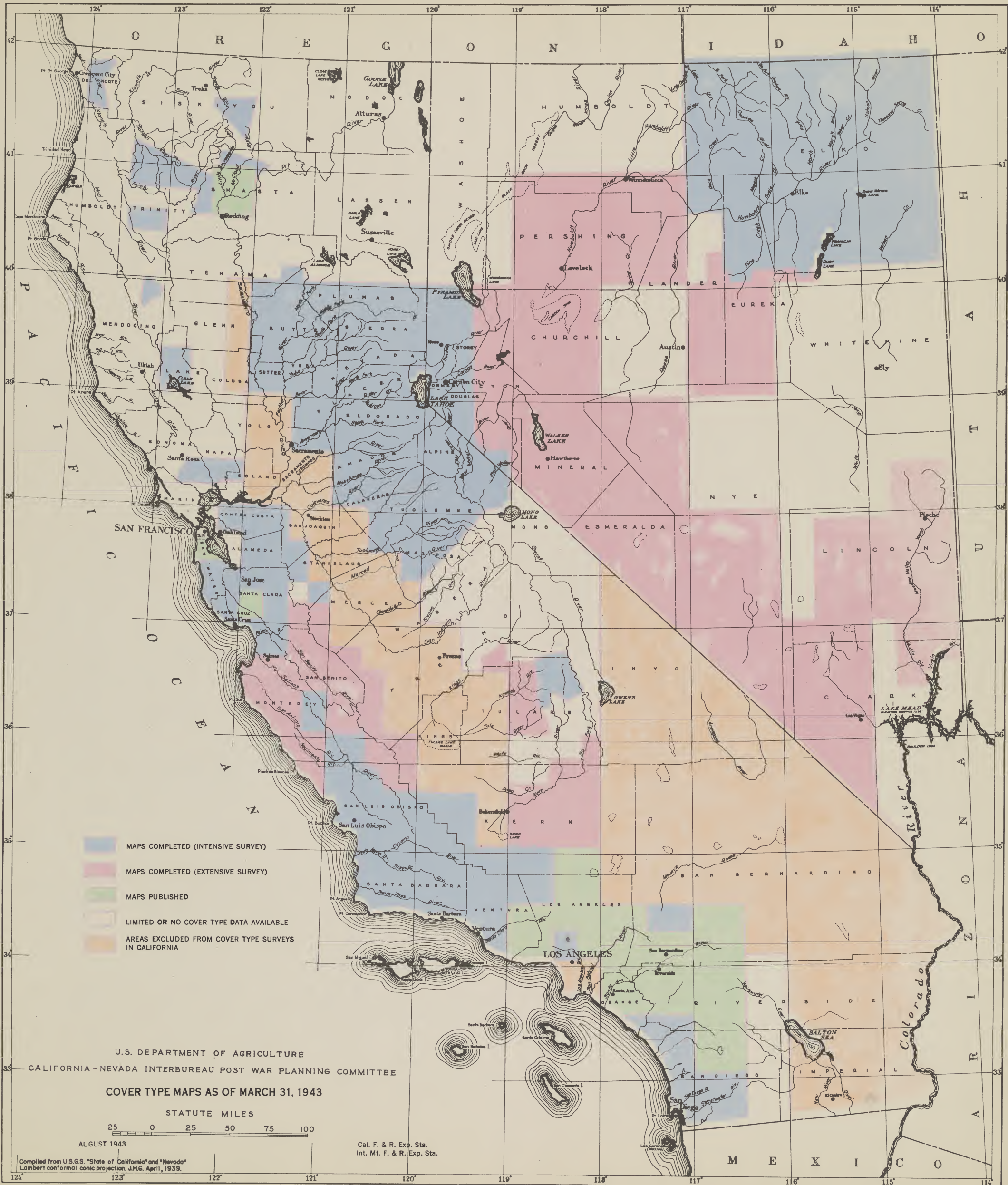
Faculty members of the School of Forestry at the University of California devote half of their time to research in forest and range ecology, silviculture, forest management, wood technology, and watershed relations.

Facilities of the Weather Bureau, Department of Commerce, in San Francisco, as well as mobile field forecasting units, are available for research on weather and fire relationships.

The Regional headquarters of the Fish and Wildlife Service, Department of the Interior, is conveniently located at the University of California for close cooperation with various allied agencies.

C. Field Stations

Field stations constitute the principal source of research records and the merits of operating these field centers have been proven by experience. A typical station is made up of headquarters improvements--dwellings, simple laboratory, warehouse, shops, greenhouse, nursery, herbarium, arboretum--located near experimental forests or ranges; test plantations; timber, forage, or watershed plots; and weather, soil, and other observation stations.



The Department of Agriculture has 12 field centers in California which, with few exceptions, are only partially completed. It is proposed to finish these stations to carry on the proposed research programs and prepare all for active work. No new stations are proposed except a range station in the Sacramento foothills and possibly a watershed station in the Sacramento drainage. A few simple field quarters are proposed to handle work that cannot be carried out from major field centers.

Two small pilot sawmills--one in the pine region, the other in the coastal redwood region--are needed for study of new methods of utilizing forest products, particularly species not considered commercial now, and for trials of new logging and silvicultural practices on experimental forests. Commercial mills and logging operations are not properly organized or equipped for experimental work, and operators cannot afford to run them for this purpose. The pilot mills will not compete with private industry.

A well-equipped regional laboratory is urgently needed for research in wood chemistry and products. Provision for this laboratory is not included in present estimates since it may be possible to expand the facilities of the Department's Western Regional Research Laboratory in Albany to include wood products; to assist the State in founding a laboratory at the University of California Forestry School in cooperation with the Agricultural Experiment Station and the California Forest and Range Experiment Station; or to establish locally a branch of the Madison Forest Service Laboratory.

Considerable expenditures will be necessary to restore research installations at stations that have been placed on a maintenance-caretaker basis because of lack of funds. Many plot and experimental-tract boundaries must be retraced and marked, the identity of thousands of trees and other features must be re-established, and inventories and measurements must be brought up to date. This work should be completed early in the post-war period to enable publication of accumulated results and beginning of long-term studies.

D. Experimental Forests and Ranges

Eleven experimental forests and ranges, located near field stations and representing major problem areas, are available for demonstrations, practical experimentation on a large scale, and intensive plot work.

There are no experimental units in the southern redwood old growth, Coast Range Douglas fir old growth, sugar pine-ponderosa pine old growth of high site quality, and northern foothill sheep ranges which will seriously handicap research in these areas until acquired.

Studies aimed at extension of cork-oak planting and farm woodland management must be conducted in cooperation with private landowners or public land administrators. Many plots are already available under permits, and on these observations can be continued on results of range brush burning, timber culture, insect damage, Ribes ecology and control, plant succession, and similar aspects.

E. Research Reserves

Experimental forests and ranges subject to intensive use and manipulation often are not suitable for the study of natural changes in vegetation and soil. Large areas in the national parks and forests covering a wide range of conditions are available for this purpose. Research reserves are of widespread interest among scientists, and numerous tracts have been nominated from time to time, but only four, totaling approximately 9,000 acres, have been set aside by public agencies.

Expanding human uses are rapidly restricting the number and size of natural areas, and prompt action should be taken to set aside suitable areas. Cooperation of botanical and soil-research agencies should be sought in surveying and marking boundaries, fencing, inventorying vegetation, and starting research. Perhaps first attention should be accorded California's numerous tree species of restricted range not adequately protected in parks.

F. Other Facilities

Nurseries for the production of trees, shrubs, or grasses are maintained by the Forest Service at Susanville, Quincy, Placerville, and Devil Canyon; by the State at Davis; by the Soil Conservation Service at Pleasanton; and by Los Angeles County at Hemminger Flats. Some of these are inactive at present. Additional small research nurseries are planned for special studies of sugar pine and species suitable for planting in brush fields.

Collections of native and exotic trees and shrubs are maintained in botanical gardens at Santa Barbara, Mills College, Santa Ana, and elsewhere. An excellent collection of pines has been developed at the Institute of Forest Genetics at Placerville. At Chico Plant Introduction Station and in other scattered locations, cork oaks and other exotics serve as important sources of seed and specimens. More arboreta are needed, however. Valuable herbariums are located at Stanford University, University of California, California Academy of Sciences, Pomona College, and several other institutions.

Publication and extension facilities of forest and range research agencies are mostly undeveloped. They need to be amplified to enable adequate printing, illustration, projection, and field demonstrations of good forestry and range practices.

General situation

Detail inventories and surveys covering in part, extent, condition, and character of use for all forest resources, are fundamental to good land management. The lack of accurate data of this kind has been universally recognized as the weakness in the development of resource plans and considered of highest priority in work to be done in a post-war program. Such data collected in the past have been either too general in character, too limited in scope, or too restrictive in purpose to fit the over-all needs. The inadequacies of base maps have often prevented the collection and recording of data to the degree of accuracy desired.

In recent years tremendous strides have been made in the use of aerial photographs. Techniques have been developed for the assemblage of accurate base maps and the delineation of vegetative features with a minimum of field checking, which greatly outmode previous accepted practices. New skills and trained personnel with these photographs as an outgrowth from the present World War should be fully utilized wherever possible. At present aerial photographs are available for 60% of the forest land in this State, with 40% still to be flown.

Two types of surveys or inventories that are needed on forest lands of California are: (1) basic inventories and surveys, designed to be useful in most forest activities; (2) specialized surveys, restricted to one or at most a few specific fields.

Basic Inventories and Surveys

Topographic and planimetric maps

Acceptable topographic and planimetric maps on a field scale of 2 inches to 1 mile can be prepared from adequately controlled aerial photographs flown on a scale not less than 1: 20,000 (about 3 inches to 1 mile). Such maps are sufficiently accurate to permit their reproduction on a scale as large as 4 inches to the mile if so desired.

The usual latitude, longitude, and plane coordinates, U. S. Land Office townships and sections, elevations, drainages, contours, and cultural features are shown. Planimetric maps are a preliminary step in the preparation of topographic maps and include all the features except the contours. They are also extremely useful in presenting detailed information, inasmuch as they do not have unnecessary details to obscure the data or make the maps difficult to read.

Topographic maps completed to a satisfactory standard now cover only 5,701,540 acres of the forest land area.

Soil Surveys

A soil survey of the forest lands of California has never been attempted, this work so far having been directed towards the completion of the more important agricultural areas. Graphic inventories of the soil resources of the upper watershed lands are a primary requisite to proper utilization as well as preservation of the soil.

Modern surveys of this kind, along with the accompanying laboratory test, supply vital information on soil-water relationships and in addition the range of productive values. No adequate plan for full productive use of water can be completed without adequate consideration of soil distribution, structure, and volume. Information on water retention characteristics of the soil, the surface condition, erosion, and erodibility is particularly needed for the solution of critical water management problems. No satisfactory plan for land use can be developed for any watershed lands unless full consideration is given to the soil, its potential productivity, and its reaction to various uses.

For the most advantageous use in mountain areas, soils data must be presented in final form directly related to natural cover types. Specifications will be developed universally for complete treatment to avoid unnecessary duplication of coverage. Area of forest land recommended for soil survey totals 45,632,000 acres.

Geological Survey

Completion of the Geological Map of California, scale 1: 500,000, issued by the State Division of Mines, is essential in the consideration of projects involving soils, water, use, mineral deposits, fault lines, dam sites, building materials, and heavy construction. Area covered by existing State maps totals 36,672,000 acres, while 8,960,000 remain to be mapped. Unsurveyed portions should be completed to the standards of the existing map, to be supplemented by a report describing its principal features, particularly those affecting the water relations, such as depth and amount of weathering and fracturing.

Forest Survey

This project is of nation-wide scope, the California portion of which will provide the broad over-all facts on forest resources. This information is essential to practically all planning and administrative agencies and groups that deal with wild land problems.

A. Cover type maps show the extent and location of existing natural vegetation. Improved techniques enable the preparation of such maps from aerial photographs, supplemented with a minimum of field checking. Broad classes of tree, shrub, and herbaceous vegetation, the density of tree and shrub cover, and the density and age class composition of timber and cordwood stands are delineated and described with separate symbols. Other maps requiring supplemental field work show composition of cover by dominant species and productivity ratings for timber and potential timber lands.

Data collected by special field crews have been compiled on small-scale topographic maps for approximately 21,000,000 acres. First priority is the preparation of similar maps from aerial photographs for the remaining 25,948,000 acres of forest land, before reworking the existing maps to the same standards.

B. A timber and cordwood inventory. This survey will provide an estimate by counties and broad ownerships, of the area and density of various kinds of timber and cordwood stands. It will include species, quality, and volume, rates of timber growth and depletion, and the future requirements for forest products. Area to be covered is estimated at 28,000,000 acres within forest land boundaries and 4,000,000 acres of scattered farm woodlots in the agricultural belt.

Where intensive management of small local areas is planned, more detailed and specialized surveys are needed such as described under "Timber Survey," below.

Specialized Surveys

Timber Surveys

Data on type, site, condition of stand, age-class distribution, amount and location of reproduction, and need for cultural measures or protection against insects or disease, are required to determine cutting practices, calculate future growth and yield, and to carry out the many phases of a workable timber management plan. It is estimated that a 5% cruise will be sufficient for these purposes when dealing with large areas. Satisfactory timber surveys are now complete on about 1,080,000 acres, while an additional 5,930,000 acres are still to be covered.

After the first cutting a less intensive inventory is needed to determine the volume and condition of the reserve stand and the amount of damage done. These data serve as a check on growth and yield calculations as well as determine the time for future cuttings. A satisfactory check can be obtained with 1% sampling. Acceptable data are now available for 50,000 acres of National Forest land, while about 1,070,000 acres of National Forest land need cruising and expanding at the rate of 25,000 to 30,000 acres per year. It is estimated that between 3 million and 4 million acres of timber land recommended for public acquisition will also need cruising.

Wood Waste Survey

A study should be made of the amount, composition, and economic availability of all materials now generally known as logging and sawmill wastes, including material used for inefficient power generation and for other processes.

All mills cutting more than one million board feet per year (approximately 150 mills) need to be classified as to operating procedures affecting quantity and quality of waste material. Intensive analysis should be made at 50 to 75 logging and sawmilling operations as a sample upon which to base the final results of the survey.

Reforestation Survey

Logged-off timber land now covered with brush should be surveyed to determine the extent and scope of planting work required to restore it to timber production. There are approximately 6,100,000 acres involved, of which 2,500,000 acres are in National Forests and 3,600,000 acres in private lands. Surveys to date have been confined to about 50,000 acres of national forest land, leaving 6,050,000 acres to be covered. On small and isolated tracts these data could be obtained by the timber survey.

Blister Rust Surveys

Areas remaining to be surveyed for blister rust control are minor and will be covered in connection with the action program for major areas, which is outlined in the section on work plans.

Insect Hazard Surveys

Where there is a possibility of extensive damage by insects in the future, necessary control measures and timber cutting practices should be planned to eliminate or minimize the expected damage. This study calls for classification of risk for slightly over 6,000,000 acres of virgin pine stands, of which 2,500,000 acres have been completed to date at acceptable standards.

Insect Damage Surveys

Annual surveys will be made on both private and Federal forest lands to (1) measure the year-to-year fluctuations in insect infestations, (2) measure the volume of standing timber destroyed annually by forest insect pests, and (3) to locate the areas where immediate control measures are needed. The surveys will also provide the basis for current advice and assistance to land managing agencies in planning and conducting insect control programs and in shaping management policies.

The ultimate program calls for annual coverage of adequate intensity on about 12,300,000 acres in the commercial pine belt in California. Under present practices only about one-fourth of the total acreage is being adequately surveyed each year.

Range Surveys

The intensive management of range lands requires an inventory of the forage resource; of the factors affecting range use such as water; existing facilities, including fences, pastures, corrals, etc.; and the natural features that influence livestock grazing. Areas requiring special treatment, reseeding, erosion control, water spreading, etc., need a more detailed survey.

The area of good range land requiring intensive management in public and private ownership includes approximately 15,326,000 acres. The standard range surveys have covered to date about 8,770,000 acres. Some additional work is required within this area to bring the work up to an acceptable degree of accuracy and make it usable in perfecting plans.

Recreation Surveys

These surveys embrace an inventory of forest lands, including intermingled private holdings, as to their recreational values, a determination of the types of recreational use for which they are best suited, and a study of the expected future needs in terms of intensity of development. Attention is also given to the integration of recreation with other uses of public and private lands.

A large proportion of the necessary developments to meet recreational demands for both summer and winter use after the war must be directed to areas on which no satisfactory survey has ever been made. Area to be covered by the present survey has been estimated at two million acres. An acceptable inventory has been completed for one million acres, cataloguing the extent of usable areas with description of vegetation, water, topography, and surrounding recreational interests. The remaining one million acres will require both inventory and survey.

Wildlife Surveys and Inventories

As a foundation for the intensified management of the big wildlife resource in California after the war, various specialized kinds of inventories and surveys of mammals, birds, and fish and their habitats will be needed. Consideration of problem species and problem areas will be of high priority. Certain phases of these surveys will come through existing cooperative relationships among agencies within the Department of Agriculture, other Federal Departments, and state and community groups as well.

Water Resource Inventory

The water resource inventory will form the basis for watershed management for maximum production and use of water and the retardation of erosion and flood runoff. It will include the amount and seasonal pattern of precipitation, extent of watershed evaporation losses, amount and rate of transpiration, infiltration, streamflow and groundwater relations for approximately 80 drainages.

Beyond a summation of physical data the inventory will provide an analysis of watershed conditions affecting the production and use of water. Maps will be prepared to show physical data, land ownership and use. The information on geology, soils, erosion, cover types and land use assembled for other projects will be utilized in making the water relations analyses. Infiltration studies will be conducted in conjunction with the water inventory and the data will be interpreted to evaluate the effects of existing and proposed land uses upon the water cycle of the drainage area.

Erosion Survey

Erosion surveys will be made to determine the location, extent, and character of erosion problem areas, their significance, and the type of remedial measures required. The surveys are designed to point up erosion problems on forest lands and to aid in determining the priorities of corrective measures. These surveys will be limited to the more severe types of erosion occurring on road slopes, along stream channels, on range lands, in mountain meadows, and in logged and burned areas where the problem is obviously serious and the treatment required is usually apparent. Sheet and rill erosion will be inventoried by the Soil Surveys.

Flood Control Surveys (U. S. Department of Agriculture)

The purpose of the U.S.D.A. Flood Control Surveys is to determine flood and erosion source areas and to develop economically feasible measures for the retardation of runoff and the control of erosion. The post-war surveys will be a continuation of the work authorized under the Flood Control Act of June 1936 and subsequent amendments.

It will be noted that the objectives of the flood control surveys are in part duplicated by those included under the water resource inventory. The water resource inventory, however, is a long-term project which may not be completed in time to meet the needs of flood control action programs in critical watersheds during the early post-war period. The flood control surveys are recommended for watersheds with serious flood and erosion problems for which corrective action is urgently needed. They will draw together data as the basis for flood control action programs in the demobilization and immediate post-war period, thereby avoiding the delay attendant on utilizing data from the water resource inventory. Preliminary examinations on these watersheds, as previously authorized by Congress, have been completed.

The watersheds recommended for report revision or completion are those of the San Gabriel, Santa Maria, and Santa Ana Rivers, involving approximately 4,000,000 acres. Watershed surveys of the Los Angeles and Santa Ynez River drainages, involving about 1,113,000 acres, have been completed, and the action program for the Los Angeles watershed has already been undertaken. Further inter-agency consideration of flood control needs may add other watersheds to the above list.

THE TRANSPORTATION SYSTEM FOR FOREST LANDS

A Tool for Forest Land Management

While base maps and resource inventories are fundamental requirements for protection and administration of forest lands, accessibility is a necessity before either protection or use is possible. The importance of an adequate transportation system is clear, as well as the position it has as one of the prerequisites to forest land management.

The concept of transportation planning varies somewhat among the federal, state, and county agencies interested in this activity. The administrative agencies of forest lands are interested in planning their system with principal consideration to the protection and management of their resources. On the other hand, those groups whose main responsibility is to serve existing conditions, are only interested in handling the traffic demands as they develop. In the one case they are always looking ahead and guiding the direction of development, while in the other, they desire to confine themselves to the current problems as they arise.

A transportation system for forest lands in California should be composed of two component parts: (1) facilities justifiable on the basis of a single purpose; (2) facilities justifiable for several purposes. In the first category would be roads, trails, landing fields, and helicopter landing spots solely for protection from and control of fires. In the second category would be included roads and trails development, utilization, and general administration of forest resources, aside from protection, and trans-forest routes of "through travel."

Necessary transportation facilities along the lower limits of the forest lands and adjacent to the agricultural areas are considered practically complete. Where additional facilities or betterment works are needed they should be included in the state and county programs. The needs in the National Parks and on Indian lands will be presented by the Department of the Interior.

A fully integrated plan has been designed to provide adequate protection and complete multiple-use management for all forest lands within the National Forests. It has taken into account the factors of accessibility, connections with county, state, National Park, and Indian Service road and trail systems and necessary through routes of traffic across the National Forests. Any eliminations from within this framework will naturally lessen or even destroy the effectiveness of the ultimate system.

Single-purpose facilities for fire protection:

Extent and standards of transportation system required

The needs for fire protection require complete coverage of all forest lands by an integrated pattern of roads, trails, and landing fields at standards that permit reaching every parcel within a calculated time interval.

Protection road and trail standards range from the simple, unimproved blazed path leading up to isolated fire lookout stations to well aligned, hard packed dirt or oil-mix roads that will permit fast attack by high speed pressure pump tankers or enable big motor transports to rush in 25-ton bulldozer equipment for line construction. Some landing fields will be small cleared spots for helicopters; others a comparatively inexpensive ridge top runway for small land planes. A few will have paved runways for landing big transport ships for manpower and supply.

The mileage constructed solely for fire protection constitutes 32 percent of the entire transportation system, and an additional 58 percent is also used to some extent for the same purpose.

Of the 9,387 miles built so far as protection roads, 40 percent are in satisfactory condition, and 5,631 miles are non-existent or require betterment.

Trails. There are 23,482 miles of foot, horse, tractor, and jeep trails in the protection system, of which 8,026 miles exist at satisfactory standards for safe travel, while 11,945 miles must be built or improved.

Plane Landing Fields. Five now exist, but all are in need of some improvement. Eighty additional fields are required for landing transport and light, fast planes, making a total of 85 on the system.

Helicopter Fields. Twenty-four major concentration points are proposed for servicing, overhauling, and off-season storage. Spotting of landing points is still contingent upon further developments of the helicopter, particularly with respect to carrying capacity, speed, cruising radius, and ceiling. Present indications are that about 1,000 will be required, but landing-spot preparation will be a minor operation performed incidental to other project work, such as trail and firebreak construction.

Multiple-Purpose:

Resource Roads. These roads may be termed as the secondary network, the feeders, or in some cases the relievers of the forest highway system. A major share of these roads are fundamentally a part of the fire protection road system, but, like the forest highways, serve a considerably broader field of use. They are of much higher type than a single-purpose road, being constructed for two-way traffic and the transportation of heavy loads with a minimum of interruption from other traffic. In addition to roads, there is a considerable mileage of horse and foot trails constructed primarily for forest users which is far from adequate to meet the needs. In the lower country, protection trails are often used for resource development, but in places they are neither properly located or of the type to satisfy certain needs, such as sightseeing and pleasure hiking.

The comparatively small mileage of connector roads is limited in scope of service. For example, a road that extends to a campground serves only protection and recreation, while a road to a sawmill or woods operation serves only protection and timber. Even these will carry their share of public travel, merchants, and forest workers.

Since these resource facilities are of greater service to the public in fields of activity other than fire protection, they are financed with funds secured by the land managing agencies who plan their location and construction to meet the particular needs in resource management.

There are 18,566 miles of two-lane surfaced or paved resource roads, of which only one-third are now satisfactory and 11,902 miles are non-existent or must be improved.

Forest Highways. The primary forest road network, coordinate with, rather than first in matter of relative importance, is the forest highway system. They are the trunks into, across, and along the crests of forest lands. These arteries are essential routes of access for protecting the forest lands from fire, but the bulk of the traffic is created by forest users, cross-country travel, and resource development. These uses consequently determine the standards. They are usually built or initially improved to highway standard with Federal funds but are maintained by and as part of the state and county road systems.

The National Forest highway system consists of 1,757 miles in Classes 1 and 2, of which 1,032 miles are non-existing, unimproved, or inadequate for full National Forest development.

